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# THE
# EXTRA PHARMACOPŒIA

MARTINDALE
AND
WESTCOTT

VOL. II

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THE

# EXTRA PHARMACOPŒIA

OF

# Martindale and Westcott.

REVISED

BY

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AND

W. Wynn Westcott, M.B.Lond., D.P.H.
H.M.'S CORONER FOR NORTH-EAST LONDON.

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## VOL. II.

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ROYAL COLLEGE OF ... OF ENGLAND
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# INTRODUCTION.

This volume is intended as an Addendum to Vol. I. In it are contained matters mostly of an Analytical or Experimental description.

The subjects dealt with in pages **1** to **79** of this volume are arranged for ease of reference in the same sequence as in the body of Vol. I.

The question of Poisons (in the light of the Poisons and Pharmacy Act 1908) has not received full consideration in this volume, as circumstances hardly necessitate it—though some are indicated. In Vol. I., however, we have pointed out, as in the previous Edition of the Extra Pharmacopœia, by means of the signs (IP) and (P) into which part of the Poisons Schedule any substance falls.

The Cross References in the following pages, *unless otherwise stated*, refer to Vol. II., and in each instance are in heavy type, thus **100**.

For List of Abbreviations see Vol. I. A further list used in the Organic Analysis Chart is given on page **283**.

The subject matter of this volume is indexed in detail in Vol. I together with the Index of that section of the work.

W. H. MARTINDALE.
W. WYNN WESTCOTT.

London,
July 9, 1912.

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# APPROXIMATE EQUIVALENT DOSES.

## WEIGHTS. IMPERIAL TO METRIC.

| grain | Gm. |
|---|---|
| $\frac{1}{100}$ | = 0·00065 |
| $\frac{1}{64}$ | = 0·001 |
| $\frac{1}{50}$ | = 0·0013 |
| $\frac{1}{40}$ | = 0·0016 |
| $\frac{1}{32}$ | = 0·002 |
| $\frac{1}{30}$ | = 0·0022 |
| $\frac{1}{25}$ | = 0·0026 |
| $\frac{1}{20}$ | = 0·0032 |
| $\frac{1}{16}$ | = 0·004 |
| $\frac{1}{12}$ | = 0·0054 |
| $\frac{1}{10}$ | = 0·0065 |
| $\frac{1}{8}$ | = 0·008 |
| $\frac{1}{6}$ | = 0·01 |
| $\frac{1}{5}$ | = 0·013 |
| $\frac{1}{4}$ | = 0·016 |

| grain | Gm. |
|---|---|
| $\frac{1}{3}$ | = 0·02 |
| $\frac{1}{2}$ | = 0·032 |
| $\frac{3}{4}$ | = 0·05 |
| 1 | = 0·065 |
| grains | |
| 1½ | = 0·1 |
| 2 | = 0·13 |
| 3 | = 0·2 |
| 4 | = 0·26 |
| 5 | = 0·32 |
| 6 | = 0·4 |
| 7 | = 0·46 |
| 8 | = 0·52 |
| 9 | = 0·6 |
| 10 | = 0·65 |

| grains | Gm. |
|---|---|
| 12 | = 0·8 |
| 15 | = 1·0 |
| 20 | = 1·3 |
| 24 | = 1·5 |
| 30 | = 2·0 |
| 40 | = 2·6 |
| 60 | = 4·0 |
| 90 | = 6·0 |
| 120 | = 8·0 |
| ½ ounce (av.) | =15·0 |
| 1 ,, | =30·0 (*or nearer* 28·35) |
| 1 pound | =453·59 |

## WEIGHTS. METRIC TO IMPERIAL.

1 kilogramme ... ... ... ... = 2 lb. 3¼ oz.
500 Gm. ... ... ... ... = 1 ,, 1⅝ ,,
100 ,, ... ... ... ... = 3½ oz.
25 ,, ... ... ... ... = ⅞ ,,
10 ,, ... ... ... ... = ⅓ ,,
1 ,, ... ... ... ... = 15·43 grains.
½ ,, or 500 milligrammes ... ... = 7·7 ,,

## MEASURES. IMPERIAL TO METRIC.

| minim | Cc. |
|---|---|
| ½ | = 0·03 |
| 1 | = 0·06 |
| minims | |
| 2 | = 0·12 |
| 3 | = 0·18 |
| 4 | = 0·24 |
| 5 | = 0·30 |
| 6 | = 0·35 |
| 7 | = 0·42 |
| 8 | = 0·5 |
| 9 | = 0·54 |
| 10 | = 0·6 |
| 12 | = 0·7 |

| minims | Cc. |
|---|---|
| 15 | = 0·9 |
| 17 | = 1·0 |
| 20 | = 1·2 |
| 25 | = 1·5 |
| 30 | = 1·8 |
| 40 | = 2·4 |
| 50 | = 3·0 |
| 60 | = 3·5 |
| 80 | = 4·7 |
| 90 | = 5·3 |
| 100 | = 6·0 |
| 120 | = 7·0 |
| 240 | =15·0 |

| fluid oz. | Cc. |
|---|---|
| 1 | = 30·0 |
| fluid ozs. | |
| 2 | = 60·0 |
| 4 | = 115·0 |
| 5 | = 140·0 |
| 6 | = 170·0 |
| 8 | = 230·0 |
| 10 | = 280·0 |
| 20 | = 568·0 |
| gallon | litres. |
| 1 | = 4·546 |

## MEASURES. METRIC TO IMPERIAL.

1 Cc. ... ... ... ... = 17 minims
1 litre ... ... ... ... = 1 pint 15 fl. oz. approx.

## MEASURES OF LENGTH.

1 micromillimetre = $\frac{1}{1000000}$ millimetre, usually represented by μμ.
1 micron = $\frac{1}{1000}$ millimetre or $\frac{1}{1000000}$ metre, ,, ,, μ.
1 millimetre = 0·039370 inch
1 centimetre = 0·3937 inch
1 decimetre = 3·937 inches
1 metre = 39.370113 inches or 1 yard 3·37 inches nearly.

## Memoranda.

Ratio of circumference of a circle to its diameter = $\pi$ = 3·14159. Circumference of a circle = $2 \pi r$.

Area of a Triangle with base $a$ and height $h = \frac{1}{2} a h$.

Volume of a Cube with length $l = l^3$.

Volume of a Cylinder = $\pi r^2 h$. If $r$ and $h$ be in inches this divided by 277·278, he result is in gallons (water).

Volume of a Pyramid $= \frac{\pi r^2 h}{3}$

Volume of a Sphere $= \frac{4}{3} \pi r^3$

1 gallon of Water weighs 10 pounds; 1 gallon contains 277·278 cubic inches.

## METRIC WEIGHTS AND MEASURES AND THEIR EQUIVALENTS IN THE BRITISH PHARMACOPŒIA.

1 Gramme (Gm.) ... ... ... = 15·4323564 grains.
1 Centigramme (Cgm.) ... ... = 0·154323 grain.
1 Milligramme (Mgm.) ... ... = 0·015432 grain.
1 Litre ... ... ... ... = 35·196 fluid ounces.
1 Cubic Centimetre (Cc.) ... = 16·95 minims (nearly).
1 Metre ... ... ... ... = 39·370113 inches.

The Gramme has its decimal multiples—Decagramme, Hectogramme, and Kilogramme; and divisions—Decigramme, Centigramme, and Milligramme. The Litre and Metre have their corresponding decimal divisions—Decilitre, Centilitre, and Millilitre,—and Decimetre, Centimetre, and Millimetre.

In Continental States, where this system is now generally adopted for the dispensing and preparing of medicines, all liquids are weighed, and the terms Gramme, Centigramme, and Kilogramme only are used. This avoids the possibility of errors, which the similarity of the names Decagramme and Decigramme might lead to.

In Germany the quantities of the ingredients in prescriptions are written in decimal proportions, the gramme being understood to be the unit; the name of the integer is generally not mentioned, thus:

Rhubarb 35· means 35 grammes of Rhubarb.
,, ·035 ,, 35 milligrammes

The following abbreviations are officially used in all French educational establishments:—

Myriamètre, mm.
Kilomètre, km.
Hectomètre, hm.
Décamètre, dcm.
Mètre, m.
Decimètre, dm.
Centimètre, cm.
Millimètre, mm.
Décastère, das.
Stère, s or $m^3$.

Décistère, ds.
tonne, t.
Quintal métrique, q.
Kilogramme, kg.
Hectogramme, hg.
Décagramme, dag.
Gramme, g.
Décigramme, dg.
Centigramme, cg.
Milligramme, mg.

Kilolitre, kl.
Hectolitre, hl.
Décalitre, dal.
Litre, l.
Décilitre, dl.
Centilitre, cl.
Millilitre, ml.
Hectare, ha.
Are, a.
Centiare, ca or $m^2$.

# ANALYTICAL ADDENDA TO MATERIA MEDICA (OFFICIAL AND NON-OFFICIAL).

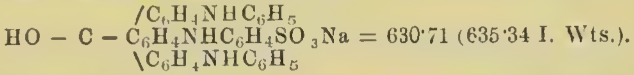
## ACIDUM BENZOICUM.

*Use as preservative*—Harmful and unnecessary.—P.J. ii/08,252. This opinion Wiley (America) reversed—L. i./09,508. May be injurious if given over a lengthy period.—L. i/09,572. It is efficient in proportion of 1 per 1000—M.1908. Salicylic Acid has the disadvantage of sometimes giving phenol odour to the food.

**Detection of, in Foodstuffs.**—Extract with a mixture of ether and petroleum ether in equal parts; this evaporated may contain saccharin (taste), salicylic acid (by its colour with ferric chloride), and benzoic acid—recognised by odour, crystalline form, and conversion into anilin blue by heating with Rosanilin and Anilin. This is Triphenyl-Rosanilin, $C_{38}H_{33}N_3O = 543.28$ (547.294 I. Wts.) or $C_{20}H_{16}(C_6H_5)_3N_3$ (?) $= 525.4$ (529.278 I. Wts.) Its Hydrochloride is called **Opal Blue,** *Syn.*, **Spirit Blue**, being soluble in spirit.

**Water-Soluble-Blue** is obtained by converting Spirit Blue (above mentioned) into Triphenyl-Rosanilin-Trisulphonic Acid by treatment with Sulphuric Acid, and is usually supplied as the Ammonium Salt. (Simpson.)

**Nicholson's Blue** is the Sodium Salt of Triphenyl-Rosanilin-Monosulphonic Acid made by sulphonating Spirit Blue, almost in the cold, composition:



$$\begin{array}{l} \qquad\qquad\quad /C_6H_4NHC_6H_5 \\ HO-C-C_6H_4NHC_6H_4SO_3Na = 630{\cdot}71\ (635{\cdot}34\ \text{I. Wts.}). \\ \qquad\qquad\quad \backslash C_6H_4NHC_6H_5 \end{array}$$

Nicholson's Blue is dyed on wool or silk from a slightly alkaline or neutral bath. The goods are washed and then developed in a bath aciduated with Sulphuric Acid. The ordinary water-soluble blues dye from an acid bath.

Dried Cranberries contain as much as 0.45% Benzoic Acid.—L. i./09,1701.

---

## ACIDUM CARBOLICUM.

(*c.f.* **Acidum Cresylicum,** *Vol. I.*)

*Methods of Standardisation of Disinfectants.*—Prof. Delépine emphasizes the importance of distinguishing the mere inhibitory or antiseptic action from the germicidal power. His experiments show that the first product of action of Mercuric Chloride on bacteria (? Albuminate of Mercury) remains when sufficiently diluted in such a way as to prevent growth, but when the Mercury is removed, as by Ammonium Sulphide, the bacteria resume activity. Hence in all testing of disinfectants the actual death of the organisms should be ensured. Further, as bacteria differ, the true value can only be found by knowing effect on a variety of organisms.

Reports on disinfectants which combine with proteid or other matter or which oxidise it must be regarded with caution when investigations have been conducted on bacteria in the absence of such organic matter (Phenols and Phenoloids are little affected by organic material of this kind). It is important to realise that the action of disinfectants is affected by proteid substances, fats, urea, uric acid, organic and inorganic salts, alkalis, acids, masses of non-pathogenic bacteria, cells, etc., all of which are present in morbid products, hence it is not surprising that Prof. Delépine does not attempt to lay down conditions for tests,—he regards the knowledge of the action of disinfectants as too 'empirical.'—B.M.J. i./11,157.

**Rideal-Walker Carbolic Acid Coefficient.** (*c.f.* B M.J., i./07,841.) Rideal and Walker advocated comparison of germicidal value of different disinfectants with Carbolic Acid.

***To conduct a Rideal-Walker determination*** we operate as follows:

First prepare a standard dilution of Phenol which will kill the test organism (*B. Typhosus*) in between 2½ and 15 minutes, *e.g.*, strength 1 in 120. The test consists in determining the dilution of the Disinfectant under examination that will kill the organism in the same time as the Phenol Dilution. One prepares a range of dilutions of the Disinfectant with sterile distilled water which will in all probability include the lethal strength, *e.g.* in a case in point 1 in 720, 1 in 960, 1 in 1200 and 1 in 1440. 5 Cc. of each of these are placed in a test tube rack alongside 5 Cc of a 1 in 120 Phenol Solution. 5 drops of a 24 hours' broth growth of *B. Typhosus* are added to each tube from a pipette. Behind these 5 tubes one has 6 more racks each containing series of 5 tubes. At intervals of 30 seconds one removes with a standard platinum loop, 3mm. in diameter, loopfuls (Rideal says "five") from the front row and adds them to the tubes immediately behind. The row behind this inoculated one is then inoculated in the same way from the front row, and so on from the original until all six racks have been treated under identical conditions with exception of the time. One then incubates for 72 hours and observes the dilution, *e.g.*, 1 in 1200 in the case in point which kills the organisms (determined by the fact of opalescence of the dilution next in order) in the same time as the Phenol dilution. The R-W. Coefficient is then $\frac{1200}{120} = 10$. It is, of course, necessary to conduct controls throughout—broth tubes both inoculated and not inoculated —*c.f.*, R. T. Hewlett, L i/09,819

It should be carefully noted that the figure for a disinfectant varies for different organisms.

The suggestion has been made to alter the Rideal-Walker Coefficient Method of examining Disinfectants by introducing organic matter—milk, urine, fæces, etc.—into the disinfectants, as it is claimed that the real test of a disinfectant is the strength and time of exposure which will enable it to kill organisms in the presence of such, but the idea has met with disfavour.

STANDARDISATION IN PRESENCE OF FÆCES.—There is no doubt that if fæcal matter be introduced as a normal standard many reputed disinfectants must lose much of their reputation.—B.M.J. i./09,286, 296.

The **Garnet Method** of conducting the test is described.—B.M.J.ii./09,213.

L.C.C. Report on Disinfectants:—Phenol Solution 1 in 20 and Mercuric Chloride 1 in 1,000 are true germicides for B. tuberculosis.—L. i./02,758.

Comparative strength with Sanitas and Formalin.—B.M.J. ii./04,16.

Disinfectants, etc., should be tested 24 hours after they have been mixed. Considerable differences arise with disinfectants which separate on standing —L.ii./08,902, 1177, 1845.

Cyllin is stated to be thrown out of solution forming an oily sediment when diluted with sea water. Sanitas Okol testing 20.5 by the ordinary Rideal-Walker test gives a coefficient of 13.6 when mixed with sea water. L.ii./08,1942 see also L.ii/08,1772.

Regulation of the sale of disinfectants.—Hewlett. Portion of Third Lecture L.i./09,893.

The "*Lancet*" instituted a chemical and bacteriological inquiry into the **Value of Disinfectants** then upon the market.

The Commission employed a modified Rideal-Walker method, using *B. Coli* as organism.

***The "Lancet" Carbolic Acid Coefficient.*** *The figure representing the percentage strength of the weakest lethal dilution of the Carbolic Acid control was divided by the figure representing the percentage strength of the weakest lethal dilution of the disinfectant* *being tested. This was done at 2½ and at* 30 *minutes and a mean of the resulting figures was taken as the Carbolic Acid Coefficient.*

The Bacteriological and Chemical results included the following :—

COAL TAR DISINFECTANTS FORMING EMULSIONS WITH WATER.—

|  | Co-efficients. | Phenols or Phenoloids. |  | Co-efficients. | Phenols or Phenoloids. |
|---|---|---|---|---|---|
| Cofectant | 9·8 | 66·27 | Pearson's Antiseptic Fluid | 2.2 | 20·7 |
| Sanitas Bactox | 9·5 | 39.7 | Jeyes' (Chemists') | 1·7 | 17·8 |
| ,, Okol | 8·9 | 48·5 | Lawes' | 1.6 | 28·2 |
| Cyllin ('bulk') | 8·8 | 40·41 | Zotal | 1·5 | 10· |
| McDougall's MOH Fluid | 7·9 | 47·13 | Krysyl | 1·3 | 14·16 |
| Kerol | 7·7 | 40·56 | Jeyes' No. 2 (Grocers) | 0·75 | 5·13 |
| Izal | 7·4 | 41·35 |  |  |  |
| Cyllin Medical | 6·4 | 32·08 |  |  |  |

CLEAR WITH WATER,—

|  | Coefficients. | Phenols or Phenoloids. |
|---|---|---|
| Crude Carbolic Acid... ... | 4·2 | 82·65 |
| Calvert's No. 5 Carbolic Acid | 2·5 | 93·26 |
| Trikresol ... ... ... | 2·5 | — |
| Lysol ... ... ... ... | 1·7 | 50·96 |

L. ii/09, 1516. For a more complete abstract of this paper, *vide* our Edition XIV., p. 17 *et. seq.*

It should be noted however that the figures for Phenols or Phenoloids were obtained by simple extraction with a solvent, the Phenol content indicated *by Bromine – the more scientific method*—was considerably less (about ½ in many cases).

The Lancet Coefficient compares % dilutions whilst the Rideal-Walker Coefficient (*c.f.* p. 2) compares the figures representing the dilutions as compared with unity—*inversely.*

The Commission **has never found such high Carbolic Coefficients as have been given by others.** Many disinfectants have therefore, been incorrectly praised. Even these (bacteriological) results are not conclusive ; many other problems suggest themselves, *e.g.*, foreign substances in the matter to be disinfected, temperature, type of diluent water used, type of micro-organisms to be destroyed,—more work is required.—L.ii/09,1616.

L.ii./09,1841 replies to critics *re* the Commission report. The *Lancet* appears to justify itself on all points. It confirms that neither with the Rideal-Walker nor with the modification of the method made use of by themselves, have they under any conditions obtained (any) Carbolic Acid Coefficient figure higher than 13 amongst the disinfectants under consideration.

Sanitas Okol and Sanitas Bactox, it is contended, were examined in an old and superseded style.—L.ii./09, 1850. Sanitas Fluid should not have been classed among tar disinfectants. This was an acknowledged slip.

Full description of Sanitas,—not intended as a powerful germicide..—L.ii./09,1850.

Jeyes' Managing Director, Ainslie Walker, intimates that Jeyes' Fluid has a Rideal-Walker Coefficient ranging from 5 to 22 according to purpose required,—*e.g.*, the brands Crude Cyllin and Special Fluid Cyllin.—L.i./10,68. See also Rideal on two of Jeyes' products.—L.ii./09,1849.

Following on the " Lancet " Commission Report a most animated discussion on the subject took place at the Cambridge Meeting 1910, of the British Pharmaceutical Conference at which Sims Woodhead and C. Ponder (Members of the Commission) read a paper on Bacteriological Standardisation of Disinfectants. They drew attention especially to the following :—

*B. Coli Communis* as test *though slightly more resistant than B. typhosus* has the advantage of being non-pathogenic and readily recognised with great certainty by the use of **McConkey's Bile-Salts Litmus Medium**, *q.v.*, without the use of the microscope (change of the litmus color by acid production).

*The Number of Micro-organisms* taken must be fairly large if consistent results are to be obtained, the margin of error being enormously greater where small quantities of a culture are used with a loop than when greater quantities are taken with a spoon.

*The Strength and Number of Dilutions* should be as close together but extend over as wide a range as possible, in order that full data may be obtained. Further, the intervals should be, as far as possible, equal, taking the form of a percentage difference. Only when these precautions are taken can the curve described be satisfactory.

*The Time during which the Disinfectant is allowed to act* must be more or less arbitrary, but it appears to be fair to all disinfectants (some of which act quickly and others more slowly) to take a mean between two extremes than to take any fixed point between two extremes (2½ and 30 minutes).

*Temperature.*—A more or less arbitrary temperature being the mean temperature met with in the temperate zone, was adopted in the experiments. It has long been known that the carbolic acid coefficient of a disinfectant may vary enormously according as the work is done with solution and emulsions kept at 55° F., or maintained at a temperature of 80° F., but the authors believe that even now the great importance of the working temperature has not been realised.

Experiments conducted on a single organism give, of course, the Coefficient. in respect of that organism only.—L.ii./10,418 ; P.J.ii./10,155 ; C.D.ii./10,193.

Kingzett and Woodcock supplied an elaborate paper. Coal Tar Emulsions (ready prepared), Homogeneous Coal Tar preparations (clear liquids, yielding emulsions with water) and "Chemical Germicides" (Formalin and $H_2O_2$) were compared with Phenol. They modified the Rideal-Walker method to make it suitable for use with $H_2O_2$ and Formaldehyde germicides for which, according to them, the process is not satisfactory. Ten drops of a forty-eight hours' broth culture were added to the usual amount of diluted disinfectant under examination, two loopfuls of this solution being taken according to the customary routine for sub-culture. Employing increased temperatures the "chemical" disinfectants showed a higher coefficiency. It is pointed out that R.-W. Coefficients become greatly depreciated when the same preparations are examined by the Martin and Chick method (employing 3% added dried fæces), *e.g.*, two Coal Tar Emulsion Disinfectants, with R.-W. Coefficient of 22 and 18, drop to 1.6 and 1.5 by this method. Very similar drops occurred with homogeneous coal tar preparations. Added "organic matter" (not fæces) did not cause so marked a drop. They are strongly in favour of the Rideal-Walker test. The R.-W. test may very well serve to determine the relative germicidal values of similarly prepared preparations of a coal tar nature; it is not applicable for ascertaining the real or relative values of other disinfectants of a different chemical nature, nor does it, of course, afford any measure of other chemical attributes and properties possessed by them and not shared by coal tar preparations.—P.J.ii./10,157.

R.T. Hewlett in criticising Woodhead and Ponder's method thought an ordinary standard loopful should be sufficient for "seeding"; he said, the apparent necessity for the large spoon (containing 0.1 Cc.) is due to the fact that McConkey's medium is not delicate enough. Extension of time limit from 15 to 30 minutes is of questionable utility, at least for "Coal Tar" Disinfectants. A standard temperature, *e.g.*, 65°F. should always be employed. Claims that the mean between 2½ and 30 minutes raises the Coefficient over that obtained at an early period. Rideal-Walker method thought to be more stringent.—P.J.ii./10,159.

Rideal, in opening the discussion, took exception to the factor $\frac{P-B}{3}$ (*c.f.* Edn. xiv. p. 18 for details of this) as in the case of Phenol the quotient would be zero. He said nothing definite is known about the relation between Br. absorption and germicidal action. Also discussed technique (size of spoon, etc.). Purvis pointed out the formula is purely tentative. F. J. Tocher said taking the mean of the 2½ and 30 minute results is not statistically sound. The accurate method of interpreting the results would be to evaluate the coefficient for each dilution, for each time period, and to calculate the mean value of the coefficients so found. The figure obtained would give the true bactericidal measure of the disinfectant compared with Phenol under conditions of the experiment.

Sims Woodhead, in reply, contended that in his method the margin of error is reduced. Protested against being asked to accept a test because it had been the conventional standard for a number of years. The difference between the use of *B. Coli* and *B. Typhosus* is not so great as to interfere with the general run of the test.

Modification of the "Lancet" Method. A 24 hour culture of *B. Coli* is used; the experiments are always carried out at a temperature of 20° C; the proportion of culture to disinfectant is 0.1 Cc. of culture to 5 Cc. of disinfectant; the amount of inoculation into subculture tubes is measured by loops instead of by spoons; the medium for subculture is prepared from beef extract according to the American standard and has a reaction of + 1.5, the titration being carried to a point where the pink colour is distinctly perceptible. Instead of the wheel a block containing four or six grooves is used. Other minor details are given including a table of dilutions. Great variation in results may be obtained with Rideal-Walker method.—it is not a method to advise for the examination of disinfectants.—Journal of Infectious Diseases, Jan., 1911, per leader in "Lancet" i/11,43.

Marchant describes a further modification of technique in the Lancet method making for greater simplicity. He proposes to substitute a modified separating flask to hold each of the mixtures of culture and graded disinfectant solution. At the necessary interval a drop from each of the mixtures can be allowed to pass into the tubes of subculture medium.—L. ii./11, 1267,1282.

### Comparison of "Lancet" figures with "Rideal-Walker" Results.

We have recently been conducting further experiments with a view to making a comparison between the figures given respectively by the R-W. and the Lancet methods.

Starting with the view that the R-W. method if correctly conducted gives results *slightly higher than the Lancet method*, e.g., *in proportion of about* 9 *or* 10 *to* 7, which we believe is accepted by some workers, we found on operating with a well-known Cresylic disinfectant (Lancet figure 5·8) that we obtained the R-W. figure of 8.

*On the other hand, another Cresylic Disinfectant gave by 'Lancet* 4·8 *and by R.-W. method* 14—! *We think therefore the 'R-W.' method—in general may give exaggerated figures—we are strongly in favour of the 'Lancet' method in preference.*

Of the organisms *B. Coli*, *B. Paratyphosus*, *Staphylococci*, *Streptococci*, and *B. Diphtheriae*, the first two were roughly far more resistant to Lysol and a series of Naphthol compounds than the others.—Zeit. f. Hygiene, Oct. 28/1909, per M.A. 1911, p. 28.

Experiments to **determine how rapidly antiseptics pass through animal membrane** as estimated by destruction of bacteria. The membranes employed were celloidin and the omentum, mesentery, diaphragm and skin of the rabbit. Carbolic Acid and Mercuric Chloride were without action in 24 hours. There was, however, one exception, i.e., a 5% Aqueous Phenol

Solution was found to pass through the diaphragm of a rabbit in five minutes. The most effective proved to be Iodine and Alcohol.—L.i./11,1366.

Phenol apparently has a selective action on bacteria in sewage filters—very few types appear in the filtrate—more especially *B. liquefaciens fluorescens* and a chromogenic. Experiments showed that the liquefying organism had no action or only a slight one on the Phenol in proportion 8.4 to 16.5 per 100,000 of water, even after a month or more. When the chromogenic organism was added the Phenol content was decreased, disappearing completely in a few days. The Phenol is thought to be oxidised by the bacteria.—Na., Nov. 24/10.

Experiments using Petri Dishes of Nutrient Agar containing pieces of metal inoculated with *B. fluorescens* showed that metals produced a kind of death zone around them—this sterile zone varies with different metals. Strong action in this way was shown by thallium, cobalt, silver, mercury, antimony, and arsenic. Slight power on the other hand was seen in the case of bismuth, lead, nickel, iron, aluminium, zinc, and copper.—L. i./11,1373.

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# ACIDUM CHROMICUM.

## LIGATURES.

### Chromic or Sulpho-chromic Catgut Ligatures.

LORD LISTER'S DIRECTIONS FOR PREPARATION —Soak the catgut 24 hours in twenty times its weight of 'preparing liquid'—made as follows :—Dissolve Chromic Acid 4 in water 240 (weight), add Sulphurous Acid Solution (*Off* ) *q.s.* to produce *green* colour of Chromium Sulphate $Cr_2(SO_4)_3 = 389.50$ (392 21 I. Wts.). Then add water to make 480 (weight), next add solution of Mercuric Chloride 2 in water 320 (weight). Dry the catgut on the stretch. The antiseptic Chromium Sulphate Solution, Lord Lister finds the nearest approach to the ideal to produce a ligature capable of fulfilling the necessary conditions as to strength, elasticity and asepsis.—L. i./o8,148, ; B.M.J. i./o8,125.

Ligatures are also supplied in carbolic acid solution 1 in 20, carbolised alcohol turpentine, and various other antiseptics. Sir Watson Cheyne treats first with liquid phenol 24 hours, then keeps in 1 in 20 phenol solution, and rinses in 1 per 2,000 perchloride before use.—L. i./o3,349. *cf.* also M.P. Mar. 13, 1907, p. 298. First in Liquid Carbolic Acid for a few hours, then in one in 20 Carbolic Solution for a week and just before use in weak Sublimate Solution.—L. ii o8,1802.

Immersion in **Clove Oil** 8 days then in Alcohol 6—8 hours, is advocated for sterilising.—Pres. Feb. 'o7,81.

A further method is to heat the catgut gradually in **Cumene** to 70° C. then in the same substance to 170° C. for two hours. Finally to rinse in petroleum benzine.

By **Cumene** or **Cumol** is intended a hydrocarbon (a) Trimethyl-benzene $C_6H_3(CH_3)_3$ [1 : 3 : 4] = 119.19 (120.096 I. Wts.) obtained by fractionation of Coal Tar ; it boils between 160° and 170° C.—when pure at 169.8° or (b) Isopropyl-benzene $C_6H_5CH(CH_3)_2$. According to Schmidt this latter boils at 152° C.,—the former body is, therefore, more suitable for sterilising catheters. The names Cumol and Cumene, or better *Cymene*, as distinct from Cumene above are, however, also given to *p*-Methyl-iso-propyl-Benzene $C_6H_4\begin{cases}CH_3\\C_3H_7\end{cases} = 133{\cdot}1$ (134.112 I. Wts.). This is obtained from Cumin Oil, and can be made from Camphor. It boils at 175° to 176° C., has Sp. Gr. 0.8678 @ 12° C., and possesses a pleasant odour.

*Hardening Treatment*—By soaking 1 hour a) in 1 in 1000 Potassium Bichromate. These are two to three weeks—soluble or (b) more durable, *i.e.*, to last 5—6 weeks use 1% solution for same period. The gut is supplied in Xylol in sealed tubes.—L. i./o7,1074

**Iodised Gut.**—Raw Gut which has been previously soaked in Ether to remove fat, known as "Ordinary Yellow Gut" (Hartmann's is a popular brand) is sterilised by soaking in a solution of Iodine 1, Potassium Iodide 1½, Distilled Water 100 for ten days. About 4 ounces of Solution is sufficient for half a dozen hanks. The Gut is then of a brown colour, in a sterile pliable condition and ready for use—remove and place in cold boiled water prior to operation. For commercial purposes best supplied in sterilised dry bottles.

Size No 1 is used for ligatures.
" " 2 , " " small pedicles.
" " 3 " " " large pedicles and abdominal wall.

**Chromic Gut.**—(*i.e.*, hardened as above mentioned, and then sterilised by the Iodine method) is used for intestinal and stomach work. No 00 for mucous suture work. No. 000000 for peritoneal work.—Mayo Robson.

**Claudius' Method**—Soaking 8 days in Iodine 1, Potassum Iodide 1, Water 100. Before using place in 3% Phenol or Normal Saline to wash the gut.—B.M.J. ii./06,738. (There is an error in the Alcoholic Solution mentioned as a substitute.)

**Salkindsohn's Method** is to immerse 8 days in Tincture of Iodine *Off.* 1, Alcohol 50% 15. The Catgut can be kept in this solution indefinitely until required for use. No. 2 Gut is the most useful for ordinary purposes.—B.M.J.i./07,809. Large reels best for storing.—B.M.J.ii./07,866. See also B M.J. ii./08,867.

*Vide* also **Iodo-Acetone**, *Vol. I.*, p. 1.

Fr. Cx. sterilises Catgut in absolute alcohol at 120° C. for 45 minutes.

**Formalin-Iodine Catgut.**

Ordinary commercial formalin gut steeped in 1% aqueous Solution of Iodine 10 days then placed in 5% Phenol till needed.

Strong and resistant.—B.M.J.ii./09, 932.

**Iodine-Formalin Catgut.**

Method of first iodizing catgut and then hardening its outer layers by formalin.— B.M.J.ii./09,1793.

Catgut prepared with Iodine and Alcohol is placed in a sterile jar and washed with a weak Carbolic Solution or sterile water; it is then treated according to the thickness of the gut in a 3% Formalin Solution jar from twenty-four to forty-eight hours, the superfluous Formalin is then washed away in running water. The Iodine Formalin Catgut thus obtained can be stored ready for use in a solution of Alcohol 50% containing 5% Glycerin and 0·5% Iodine. M.A.—1911 p. 239.

*Bacillus tetani* isolated from a sample of gut.—B.M.J.i./09,1481.

**Absorbable Iodine Catgut.**—Catgut, defatted by ether, is well boiled in absolute Alcohol for an hour, then laid in a solution of 1 part Strong Solution of Iodine and 11 parts of Water for a week. It is preserved and used from a solution of 1 part Strong Solution of Iodine and 50 parts Rectified Alcohol.—B.M.J. i./10,320.

**Kangaroo Tendon, St. G.H.** is washed with Ether Soap, treated with antiseptics and preserved in Alcohol.

**Horsehair, St. G. H.** is boiled in water 10 minutes only.

**Silk Sutures** are supplied on reels and in hanks, sizes 0, 1, 2, also sterilised in Absolute Alcohol and Phenol Solution. Silcock sterilised by immersing in Olive Oil for 12 hours and then boiling in the same and keeping in Carbolised Spirit. In infantile paralysis silk ligaments cause formation of a tough tissue or tendon.—L. ii./08,252.

**Silkworm Gut**, extra fine, fine, medium and stout in 10 and 14 inch lengths.

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## ACIDUM HYDROCYANICUM.

**Volumetric Estimation.**—Titrate about 1 Gm. (accurately weighed, kept slightly alkaline with Sodium Hydroxide throughout the test), with N/10 Silver Nitrate Solution, until a permanent Silver Cyanide precipitate is formed. The soluble double Salt, AgCN.NaCN, is intermediate. $Ag\ NO_3 = 2HCN$ or 1 CcN/10 $Ag\ NO_3$ = 0·00537 Gm. HCN. B.P. directs that 1 Gm. should require 3·7 Cc. of the Volumetric Solution, *i.e.* = 0·019869 Gm. HCN or 1·9869%.

Borax Solution in excess is added to Hydrocyanic Acid before titration with Silver Nitrate. Suitable for Cherry Laurel Water.—P.J. ii./05,910.

**Quantitative Estimation of Hydrocyanic Acid in the blood and tissues of animals post mortem.** The method is colorimetric and depends on reaction between Potassium Cyanide and Picric Acid. (Liebig's Annalen, CX *p.* 289 (1859). A Color Scale for comparison is made by mixing equal volumes of recently titrated 1/1000 HCN. and Picrate mixture (equal volumes of 0.5% Picric Acid and 5% Sodium Carbonate). This stock solution (T 500) is further diluted (T 1, 2, etc.). The estimation is made by matching the color of the given fluid or of its distillate into Picrate Mixture with that of the color scale.—A.D.Waller, Phys. Proceedings, June 18,1910.

**Detection of Traces of Hydrocyanic Acid.**

A comparison has been made of the delicacy of the Prussian blue as compared with the picrate test for hydrogen cyanide, from which it appears that the former is of at least equal delicacy to the latter.

By evaporating the Alkaline Cyanide Solution to almost complete dryness, adding 2 per cent. Ferrous Sulphate, leaving *in the cold* for ten minutes and acidification, evidence of the presence of 0.000002 grm. of HCN may be obtained. The Ferro-Cyanide reaction may be used for the detection of Hydrogen Cyanide in the blood and brain of poisoned animals with equal efficiency to the Picrate method as applied to the same purpose by Waller.—G. D. Lander and A. E. Walden. Chem. News, May 19/11, p. 240.

**Delicate Test for Hydrocyanic Acid.**—A few drops of phenolphthalin solution made alkaline with Sodium Hydroxide added to liquid to be tested. If red colour be produced on adding Cupric Sulphate Solution 1 in 2,000 (due to oxidation into phenolphthalein) Hydrocyanic Acid is proved to be present.

Phenolphthalin is made by reducing phenolphthalein with Zinc in alkaline solution.—P.J. i./05,721.

**Method of Horticultural Use.**—Employing Sodium Cyanide and acid.—P.J. ii./08,722.

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## ACIDI LACTICI BACILLI.

### Lactic Acid Bacilli Preparations.

Prof. Elie Metchnikoff, in his work "The Prolongation of Life," evolved a theory of arresting the growth of putrefactive (alkaline) organisms in the intestines, and hence stimulating intestinal digestion and diminishing toxic absorption from the bowel by acclimatising the (harmless) Lactic Acid Bacillus. He takes as his starting-point that the newly-born infant has sterile intestines, and on partaking of the first drop of mother's or cow's milk these commence to be infected. He then discusses the evils resulting from putrefied food, some of the recipients dying from the effects; others, if their resistance be sufficient, saving their lives after experiencing a severe attack of cholera. The word 'acid' makes its appearance—*i.e.*, in connection with the custom prevailing from early times of preserving food with vinegar—the product of bacteria to 'ward off putrefaction.' It is further pointed out that substances themselves producing a preservative acid—*e.g.*, milk—can be made into others—*e.g.*, cheese—which can be kept for longer or shorter periods of time. 'Kwass,' of which black bread is the main ingredient, is the chief beverage in Russia in the summer. It contains Lactic Acid. Other instances are given with the conclusion, Why not arrest putrefaction in the digestive tract as with the conserve?

Experimental consumption of large quantities of Lactic Bacilli showed that intestinal putrefaction was diminished.

It was found that with a normal diet the *Bacillus* appeared in the stools in three to four days after it had been begun to be consumed regularly with the food; that it took eight days to become properly acclimatised in the intestine, and that when this had taken place it would continue to live and thrive for twelve more days without another dose being swallowed, afterwards gradually disappearing. Regular administration caused increase in weight and bulk of faeces.

Lactic Acid, as such, has been employed for years past in dyspepsia, enteritis, &c., as also in diabetes, and locally in tuberculous ulceration of the larynx.

The conclusion was that as organisms of putrefaction only increase with difficulty in neutral or acid media, the most feasible procedure would be to introduce a Lactic Acid organism (growing in a sugar medium) into the human organism to arrest the proliferation of harmful bacteria. The bacillus known as the **Bulgarian Bacillus** (*B. Caucasicum*), isolated by Cohendy and independently by Massol from '**Yoghourth**,' a form of soured milk, was deemed most suitable, as it is the best acid producer. The acid it produces is the optically inactive variety. It is a hardy organism resisting the stomach juices and its own acidity to a marked degree.

According to Hewlett it occurs apparently in various forms. In natural soured milks for example :—

(1) *B. Bulgaricus* and *B. Massol* from Bulgarian Yoghurt and Maya;
(2) *Streptobacillus lebenis* from Egyptian leben.
(3) *Bacillus Mazun* from Armenian mazun.
(4) The "Granule" bacillus from Bulgarian Yoghurt.
(5) *Bacterium Sardous* from Sardinian Gioddu (grixoni).
(6) *Bacterium Lactis Acidi* (Leishman)

are probably varieties of only one species.—B.M.J. ii./10,1584 ; L. ii./10,402.

**Buttermilk** of many countries, **Kephir** or **Koumiss**, *vide Vol. I.* p.554, the Egyptian 'Leben Raib,' 'Prostokwocha,' and 'Varenetz' of Russia, **Yoghourth** (Yohourth) of the Balkans, and many others were forerunners of the curdled milk treatment, which recently attracted so much attention. It is believed that the Bulgarian peasant consumes as much as 10 grams of Lactic Acid daily in his diet of Yohourth.

These sour milks, as a rule, contain yeasts in small proportions, and *ergo* alcohol—the same remark applies to the artificially soured milks.

Emerson, as also Herschell, advise the presence of a carefully selected strain of yeast as a useful therapeutic aid in many affections.

The **Bulgarian Bacillus**, according to Metchnikoff, will produce as much as 2·5 grams of Lactic Acid per 100 Cc. of milk.

Succinic, acetic and formic acids are also formed by it in small quantity. This bacillus has no action on albuminoids (casein, &c.) nor fats, nor does it produce alcohol or acetone. It does not attack saccharose (cane sugar) or maltose ; it is therefore useless to add cane sugar in the hope of increasing Lactic Acid yield. For flavouring purposes the *B. paralactic* (*B. Güntheri*) is used in conjunction.

**Günther's Bacillus** is found in abundance in all spontaneously coagulated milk, and is an important Lactic Acid producer.

It modifies the condition of the curd formed,and hence is a useful addition, but it appears to die out in the finished product. It produces pure dextrorotatory Lactic Acid (no other acid) from grape and milk sugar.

**Hüppe's Bacillus** is another Lactic Acid organism.

It is almost always present in milk which has soured spontaneously.

This organism, sometimes called specifically the *B. Acidi Lactici*, differs from *B. Güntheri*, by its comparative ease of cultivation upon ordinary nutrient media.

Léon Massol took cultures of the Bulgarian Bacillus to Paris, and these gave Metchnikoff the starting point for his researches on the efficacy of soured milk.—B.M.J. i./10,57.

The characters of the chief Lactic Acid organisms may be tabulated:—

| ORGANISM AND SYNONYMS. | APPEARANCE. | PROPERTIES. |
|---|---|---|
| *Bacterium Caucasicum* (Kern); *syn.* Massol's Bacillus, *syn.* Bouchard's Bacillus, *syn.* Bulgarian Bacillus. | Large square-shaped, 5 to 6 $\mu \times 1 \mu$ showing vacuoli, slightly motile.<br>+Gram staining. | Appears to take a little time to establish itself, but ultimately is the omnipresent bacterium in milk. It is a strong lactic acid producer. |
| Hüppe's Bacillus: *syn. B. Acidi Lactici. Streptococcus Lebenis* may be closely allied. | Coccoid shape 0·4 to 0·6 $\mu \times$ 0·6 to 2 $\mu$. Usually in pairs, rarely longer chains, non-motile.<br>+Gram staining.* | Causes bitterness, breaks up fat and proteolytic substances. |
| *Bacterium Güntheri*; *syn. B. Acidi Paralactici* (Kozai). | Short rods, 1 $\mu \times$ 0·5 to 0·6 $\mu$, with pointed ends, in pairs or short chains non-motile. −Gram staining. | Gives a smooth, non-leathery form of curd. It appears to be killed off to some extent in the curdling of milk, being probably ousted by *B. Caucasicum*. |

## Methods of Examination of Lactic Acid Bacilli Preparations.

### 1.—ORGANISMS PRODUCED AND CURD FORMATION.

If properly made there is no reason why lactic acid bacilli in tablet form should not keep good for months or even years.—W.H.M.

The property of producing lactic acid is common to a vast number of organisms (*cf.* L. ii./08,957).

Loopfuls of the milk, treated with the crushed tablet, are to be examined after ten and twenty-four hours' cultivation.

The best **Staining Method** to employ is that of Gram *q.v.*, using 1% neutral red as counterstain. The Gram-staining organisms take on a deep violet, and the rest of the field is a reddish pink, less diffuse than that with eosin, which is often used as a counterstain. A copious growth of *B. Caucasicum* is essential, with exclusion of other bacteria. Curd formation should also be satisfactory.

### 2.—ESTIMATION OF LACTIC ACID.

The Pasteur Institute found in soured milk, made according to Metchnikoff, 1% of lactic acid when ready for consumption. More is formed if longer time allowed (*vide antea*).

The amount obviously depends on the content of lactose, the average of this constituent being 4 per cent. The decomposition of lactose in milk into lactic acid is a complex matter. In any case nature will not allow an optimum yield, as the bacilli kill themselves by the acid they produce—the maximum acid formation being reached in about thirty-six hours.

*It is, however, not so much a question of the quantity of acid produced as the assurance that the culture used is active and capable of*

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*The **Hüppe's Bacillus** with which we have worked has been found to stain well by Gram's method, but opinions differ.

*thoroughly establishing itself in the intestines to the exclusion of harmful bacteria, as evidenced by bacteriological examinations of the excreta.*

Wynter Blyth says the maximum amount of lactic acid formed under ordinary conditions (from milk) seems to be 0·8 per cent., which is probably not far short of the mark, so far as our work shows.

Milk, it should be noted, is amphoteric in reaction on account of its content of alkali phosphate. Phenolphthalein can be used as an indicator in titrating, but the end reaction is a little difficult to determine—it requires to be carefully looked for: 20 Cc. of the milk is a convenient quantity to titrate, using $\frac{N}{10}$ Soda.

### 3.—Casein Rendered Soluble.

At the Pasteur Institute 38 per cent. of the casein in milk could be rendered soluble by treatment with lactic-acid organisms (Metchnikoff, p. 180). Herschell states that as much as 50 per cent. of it is converted into albumose and peptone by this means.

For further details *vide* the contribution ' Lactic Acid Organisms.'—W.H.M.

### 4.—Phosphate Rendered Soluble.

Metchnikoff states that 68% of the calcium phosphate (which he terms the chief mineral substance of milk) was rendered soluble during fermentation by his process.

Our investigations gave results closely approximating this statement.

It appears that in the district around Milan spontaneously curdled milks are not used to any extent nor milks prepared by special ferments. In Sardinia, however, the people prepare and make a continuous diet of (for lack of anything better) Gioddu, Mezzoraddu, or Miciaratu, which are the products of fermentation due to *Saccharomyces Sardons* and to *Bacillus Sardons* and *Mazun*, and which resemble in composition the Lebenraib of Egypt, the Prostokwacha and Varcnetz of the Russians, the Kephir of the Caucasians, the Koumiss of the Tartars, and the Mazun of the Armenians. At Milan the grape ferment is in demand, at Turin Blastoinvertin (*Saccharomyces invertens*), in Lombardy Kephir, and at Piedmont the true Yoghourt.

From Greece we learn that Yoghourth is much in use both as a food and for therapeutic treatment. It is prepared there by adding a little lemon-juice to fresh milk, which is then kept warm for eight hours, forming a curd which is the first stage in the manufacture. From the curd thus formed a tablespoonful is mixed with boiled milk, and this procedure is repeated several times, with fresh milk on each occasion, until a Yoghourth of suitable consistence is obtained. Small spoonfuls of this latter product are added to wooden or earthenware pans containing milk which has been boiled and is still slightly warm This forms the commercial Yoghourth, which curdles in four hours at 35° C. It has at first a sweetish taste, becoming extremely acid after twelve hours In order to keep it, which one may do for as long as from five to eight days, it is poured into little bags of cotton from which the whey filters, the product thereby becoming thicker and of better-keeping qualities. Yoghourth prepared from sheep's milk is highly esteemed as a milk-food by the Greeks.

## ACIDUM PHOSPHORICUM.

*Volumetric titration* with normal Potash Solution using Phenolphthalein as Indicator is well known to give very variable results especially when considerably diluted or in presence of ionisable salts. An iodometric estimation based on reaction which takes place between Phosphoric Acid, Potassium Iodide and Potassium Bromate, especially if allowed to proceed at 20° C. for 2½ to 3 hours, is more reliable.

5 Cc. of the Acid in 5% dilution in a 150 Cc. stoppered bottle with 2 Gm. (approx.) of Potassium Iodide, 5 Cc. of Saturated Potassium Bromate Solution and 30 Cc. of water, left securely stoppered for 2½–3 hours and Iodine liberated titrated with Sodium Thiosulphate Solution — $6H_3PO_4 + 6KI + K,BrO_3 = 6KH_2PO_4 + 3I_2 + KBr + 3H_2O$. 98.064 of Acid = 126.92 parts 1. = 248.22 $Na_2S_2O_35H_2O$, or 1 Cc. N/10. $Na_2S_2O_35H_2O$ (0.024822 Gm.) = 0·0098064 Gm,

$H_3PO_4$.—Am. Jl. Ph., April '08, p. 151. (Figures revised by us to 1912 International Wts.).

In the official process of assay Magnesium Oxide would be preferable to Lead Oxide, which in fusing always attacks the glaze of the crucible. The method is also suitable for estimating Ammonium Phosphate.—P.J. ii./10,137.

**Detection of Arsenic Acid in presence of Phosphoric Acid.**

The solution of the alkali salts of the two acids, rendered faintly acid with Acetic Acid, is reduced to small volume, and treated with 10–15 Cc. of a concentrated solution of Ammonium Nitrate. Raise to boiling and add about 1 Gm of Ammonium Molybdate. When this has dissolved, the liquid is boiled for about 1½ minutes. If Arsenic Acid is present, a white precipitate forms. By this method 0.002 Gm. of Arsenic Acid can be detected in the presence of a large quantity of Phosphoric Acid. Salts of Ca, Sr and Mg. do not invalidate the test, but render it rather less delicate.—J C.S.A. ii./10,896.

**Metaphosphoric Acid** $HPO_3$ = 79·44 (80·048 I. Wts.) is equivalent to *Glacial Phosphoric Acid*, and is employed as an Albumin Test. (*vide* p. **147**)

Pyrophosphoric acid is formed as an intermediate compound in the hydration of metaphosphoric acid. The hydration does not take place according to any simple scheme, and a method of estimating meta acid in a solution of all three varieties by means of barium chloride is described. From the depression of the freezing point of aqueous solutions of various varieties of pyro and meta acids, it appears that, when these acids are prepared by dehydration of orthophosphoric acid, there occurs association of the molecules, but when prepared by decomposition of the lead salts by hydrogen sulphide simple molecules result.—Myers & Hold, Manch. Phil. Soc. per Na. March, 11, 66.

## ACIDUM SALICYLICUM.

**Detection of, when used as Preservative.**—Concentrate liquid (distil off any alcohol) in presence of Alkali and Sodium Chloride, acidify and shake out with Chloroform, evaporate and add Ferric Chloride Solution, red colour.—P.J. ii./05,279. Its use to preserve foods, where otherwise rapid decomposition would occur in hot weather, is upheld.—L. ii./04, 638,916,963 ; B.M.J. ii./04,854 ; i./05,455.

A Departmental Committee inquired into use of preservatives and colouring matters added to foods. Not more than 1 grain per pint of liquid and 1 grain per pound of solid food is permissible. Presence may impair digestion, but said not to be injurious.—L. i./03,717 ; ii./04,1544. Though harmful, is less virulent than supposed. As preservative unnecessary.—L. ii./06,1613.

Methods of detecting Artificial from Natural Salicylic preparations.—Am. Jl. Ph. Sept. 1908. P.J.ii./08,585.

## ACIDUM TARTARICUM.

**Estimation of Lead in Tartaric Acid.**

Best English tartaric acid as a rule does not contain more than 5 parts per million of lead and rarely exceeds 10. Foreign acids contain more. (*c.f.*Govt. Report *infra*).

Prepare a standard lead nitrate solution in water 0.4 Gm. in 250 Cc. This should be kept distinctly acid, and is diluted 100 times for use. 1 Cc. of this diluted solution contains 0.00001 Gm. Pb. 7 Gm. of tartaric acid are dissolved in 50 Cc. of water in a Nessler glass with internal diameter 2.5 Cm., and in another 2 Gm. of the same acid are dissolved in the same amount of water. To the first, ammonia is added in excess, and a few drops of a 10 per cent. potassium cyanide solution are added to prevent the iron and copper from interfering with the sodium sulphide solution which is then added to the first Nessler glass.

The amount of lead solution added to the 'dummy' to match the colour of the solution of the sample on adding sulphide is the amount present in 5 Gm. of the sample. One arrives, therefore, at the amount of lead present in parts per million ; *e.g.*, 5 grammes of acid requiring 5 Cc. of diluted standard lead solution to balance coloration represent a content of 10 parts per million. Do not add lead solution after the sodium sulphide, this is a grave source of error.

To eliminate the inherent colour of the solution of the substance before adding the sulphide it may be necessary to add a minute quantity of burnt sugar to the 'dummy.'

If the sample be rich in lead, use correspondingly less of it, *e.g.* 2 Gm.

**Method of Producing Lead-free Tartaric Acid.**—Where the proportion of lead is excessive (*e.g.* 40 parts per million), pure lead-free acid for use as 'dummy' will be necessary. To prepare this 250 Gm. of the best acid obtainable are placed in a strong bottle fitted with rubber cork, and 1000Cc. cold saturated hydrogen sulphide solution are added to nearly fill the bottle, which is (cautiously) then well shaken to dissolve the acid. Great internal pressure is produced owing to comparatively slight solubility of hydrogen sulphide in solutions of citric or tartaric acid. Allow to stand one day, filter, evaporate and crystallise. The solution on concentrating may become straw-coloured, which can be removed by stirring into the hot solution a crystal of sodium chlorate. The first crop of crystals equal to half the acid taken will be absolutely lead-free.—C.D. March 15,1905.

*The Government Laboratories (MacFadden's Report to Local Government Board) found no Arsenic in the English Tartaric Acid and in no case more than* 0.002% *of lead—approximately $\frac{1}{7}$ grain per lb. With nearly half the foreign acids this figure was exceeded—the worst being a German acid and containing* 0.0062% *of Metallic Lead.*

*Minute amounts of Lead and Arsenious Oxide below* 0.002 (= $\frac{1}{7}$ *grain, per lb.*), *and* 0.00014% ($\frac{1}{100}$ *grain per lb.*) *respectively, would not justify condemnation.—B.M.J.ii./07,* 1140, *c.f. also p.* **19**.

*C.R.*, 1908, gives test to limit sulphates and advises lead should not exceed 10 parts per million.

Criticism of the Reference Committee's pronouncement on the color estimation of lead. 20 per million might well be adopted as a counsel of perfection.—C.D. ii./09, 93.

**Acidum Glutaricum.** *Syn.* PYROTARTARIC ACID. $COOH.(CH_2)_3.COOH.$ = 131·07(132·064. I. Wts.).

*Dose.*—? but assumed as of Tartaric Acid.

Isomeric with Pyrotartaric (Methyl-Succinic), Ethyl-Malonic and Dimethyl-Malonic Acids four isomers being possible. Colourless crystals,—soluble in water and alcohol. M.Pt. 97° C.

Experimentation by injection of dogs rendered diabetic by means of phloridzin,—showed its value in diabetes. The excretion of Nitrogen diminished. Seems to act by preventing the splitting up of the tissues, or food into sugar and urea.—B.M.J. ii./07, 542 (See also M. 1908,114).

## ÆTHERIS NITROSI SPIRITUS.

This preparation kept under the best conditions in retail shops undoubtedly decomposes, aldehyde and acetic and nitrous acids being among the products of decomposition. There is, besides, a certain amount of loss by evaporation of ethyl nitrite. MacEwan in 1884 showed that under the best conditions the acidity of the spirit increases on keeping as well as the aldehyde. Decomposition of ethyl nitrite is inevitable, because the preparation contains about 10 per cent. of water, so that the ethylic ester and water interact the preparation getting into a state of incipient decomposition, which is consummated as soon as the spirit is agitated with air, as is unavoidable in serving the liquor to customers. The first change may be the formation of aldehyde and nitrous acid, thus:

$$C_2H_5NO_2 + O = C_2H_4O + HNO_2.$$

Then the aldehyde is oxidised into acetic acid.

In the course of time the nitrous constituent of the spirit entirely disappears, but aldehyde, one of the most readily oxidisable bodies, remains. It was also proved that formic acid is one of the products of decomposition of sweet spirit of nitre made from methylated spirit.

It is generally packed by the manufacturer in full bottles as soon as made, and its strength ascertained and recorded when bottled. It therefore reaches retailers practically of diminished strength, and it is their duty to store the spirit in cool cupboards and in well-filled bottles, kept preferably, upside down.—C.D. i./11,17

With regard to the '*volatilisation*' of Ethyl Nitrite, Cowley finds that every trace of Ethyl Nitrite disappears from a solution within a few days in ordinary vessels. As to decomposition in an *Aqueous* Solution, a mixture containing Spirit of Nitre loses the whole of it in three days. With regard to decomposition in *Alcoholic Solution*, this is of such varied character that it is impossible to represent by an equation, though the following appears to be preliminary :

$$2C_2H_5NO_2 = CH_3COH + C_2H_5OH + 2NO.$$

Solutions in Absolute Alcohol change less rapidly than those in 90% Alcohol on account of the Water present.—C.D. April 15/11,556.

Southall's Lab. Rep., 1912, says: 'convinced that loss of Ethyl Nitrite on keeping is due to volatilisation. Loss by hydrolysis in spirit of official strength is nil in 10 months.

*C. R. Supp.* 1911.—1 volume should be required to yield not more than 2 or less than 4 volumes of Nitric Oxide gas corresponding to not more than 2.65 or less than 1·51% by weight of Ethyl Nitrite.

## ALCOHOL.

**Rule for Calculation for Dilution of Alcohol.**

If **V** be volume percentage of the stronger alcohol and **v** of the alcohol required—

I. *By volume.* Mix **v** volumes of the stronger alcohol with distilled water, *q.s.* after cooling to make **V** volumes, *e.g.* to make an alcohol 43% from alcohol 95% take 43 volumes of the 95% and make up to 95 volumes.

II. *By weight.* Proceed on same lines by weight throughout.

**To Transpose Volume per cent. of Alcohol into Weight per cent.** The volume per cent. is multiplied by 0·7938, and the product divided by the Sp. Gr. of the liquid, *e.g.*, $\frac{80{\cdot}22 \text{ V per cent.} \times 0{\cdot}7938}{0{\cdot}863} =$ 73·7875 weight per cent. To express the **Weight per cent.** as **Volume per cent.** divide the weight per cent. by 0·7938 and multiply by the Sp. Gr. of the liquid, *e.g.*, 90·29 per cent. by weight = $\frac{90{\cdot}29 \times 0{\cdot}822}{0{\cdot}7938} = 93{\cdot}49$ V per cent.

**To state Volume per cent. as Alcohol of Proof Strength.** Multiply V per cent. by 1·753 and deduct 100 from the product. Thus 65 V per cent. = 65 x 1·753 − 100 = + 13·945° over proof. Further, alcohol of 25 V per cent. = 25 x 1·753 − 100 = −56·175° proof, *i.e.*, 56·175° under proof.

B.P. 1885 states: Proof spirit = about 57 per cent. alcohol ($C_2H_5OH$) by vol., *i.e.*, 57 parts alcohol with water produce 100 parts proof spirit.

∴ 1 part alcohol will make $\frac{100}{57} = 1{\cdot}753$ (about) parts proof strength.

Laws governing the Molecular combination of Alcohol with Water.—P.J. i./10,754.

The following Table, founded on B.P. and Gilpin's Tables, shows:—

(i.) The volume of Distilled Water necessary to be added to 100 volumes of Alcohol (90%) for the production of each strength of Diluted Alcohol.

(ii.) The volumes of Alcohol (90%) and of Distilled Water respectively which, when mixed and reduced to 60° F. (15·5° C.), will produce, allowing for contraction in volume, 1,000 Cc., 1 pint, or 1 gallon of each strength of Diluted Alcohol.

The Specific Gravity and the exact Excise (Sikes') strength at 60° F. (15·5° C.), in degrees over proof (O.P.) and under proof (U.P.), of each dilution, are given in the first column.

TABLE FOR THE DILUTION OF ALCOHOL (90%) TO WEAKER OFFICIAL (B.P.) STRENGTHS.

| Volume Percentage, Specific Gravity, and Excise Strength. | Alcohol. (90 per cent.) | Distilled Water. | Volume Produced. |
|---|---|---|---|
| 70 per cent.<br>Sp. Gr. 0·8900<br>22·7° O.P.† | 100 vols.<br>777·8 Cc.<br>*648·5 Gm.<br>15 oz. 266 m.<br>124 oz. 215 m.<br>*6 lbs. 7⅞ oz. | + 31·05 vols.<br>+ 241·6 Cc.<br>+ 241·6 Gm.<br>+ 4 oz. 398 m.<br>+ 38 oz. 307 m.<br>+ 2 lbs. 6⅝ oz. | = 128·57<br>= 1000Cc·<br>= 1000Cc·<br>= 1 pint<br>= 1 gal.<br>= 8 lbs. 14½ oz. |
| 60 per cent.<br>Sp. Gr. 0·9135<br>5·20° O.P.† | 100 vols.<br>666·6 Cc.<br>*555·9 Gm.<br>13 oz. 160 m.<br>106 oz. 320 m.<br>*5 lbs. 9 oz. | + 53·65 vols.<br>+ 357·8 Cc.<br>+ 357·8 Gm.<br>+ 7 oz. 74 m.<br>+ 57 oz. 112 m.<br>+ 3 lbs. 9¼ oz. | = 150<br>= 1000Cc.<br>= 1000Cc.<br>= 1 pint<br>= 1 gal.<br>= 9 lbs. 2¼ oz. |
| 45 per cent.<br>Sp. Gr. 0·9436<br>21·2° U.P.† | 100 vols.<br>500 Cc.<br>*417·2 Gm.<br>10 oz.<br>80 oz.<br>*4 lbs. 2⅞ oz. | + 105·34 vols.<br>+ 526·6 Cc.<br>+ 526·6 Gm.<br>+ 10 oz. 256 m.<br>+ 84 oz. 130 m.<br>+ 5 lbs. 4¼ oz. | = 200<br>= 1000Cc.<br>= 1000Cc.<br>= 1 pint<br>= 1 gal.<br>= 9 lbs. 7 oz. |
| 20 per cent.<br>Sp. Gr. 0·9760<br>64·9° U.P.† | 100 vols.<br>222·2 Cc.<br>*185·2 Gm.<br>4 oz. 213 m.<br>35 oz. 267 m.<br>*1 lb. 13¾ oz. | + 355·8 vols.<br>+ 790·7 Cc.<br>+ 791 Gm.<br>+ 15 oz. 390 m.<br>+ 126 oz. 243 m.<br>+ 7 lbs. 11½ oz. | = 450<br>= 1000Cc.<br>= 1000Cc.<br>= 1 pint<br>= 1 gal.<br>= 9 lbs. 12¼ oz. |

NOTE.—*These figures are the weights necessary to produce a gallon and a litre respectively, at 15·5° C.—P.J. i./98,501. † Stevenson.

## ALCOHOL TABLE.

NOTE.—*Specific gravities are taken at* 15·5° *C.*

| Sp.Gr. | Wt. per. cent. | Vol. per cent | Sp.Gr. | Wt. per cent. | Vol. per cent. | Sp.Gr. | Wt. per cent. | Vol. per cent. | Sp.Gr. | Wt. per cent. | Vol. per cent. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0·999 | 0·53 | 0·66 | 0·947 | 36·00 | 42·95 | 0·895 | 60·26 | 67·93 | 0·843 | 82·15 | 87·24 |
| 0·998 | 1·06 | 1·34 | 0·946 | 36·56 | 43·56 | 0·894 | 60·67 | 68·33 | 0·842 | 82·54 | 87·55 |
| 0·997 | 1·69 | 2·12 | 0·945 | 37·11 | 44·18 | 0·893 | 61·08 | 68·72 | 0·841 | 82·92 | 87·85 |
| 0·996 | 2·28 | 2·86 | 0·944 | 37·67 | 44·79 | 0·892 | 61·50 | 69·11 | 0·840 | 83·31 | 88·10 |
| 0·995 | 2·83 | 3·55 | 0·943 | 38·22 | 45·41 | 0·891 | 61·92 | 69·50 | 0·839 | 83·69 | 88·46 |
| 0·994 | 3·41 | 4·27 | 0·942 | 38·78 | 46·02 | 0·890 | 62·36 | 69·92 | 0·838 | 84·08 | 88·76 |
| 0·993 | 4·00 | 5·00 | 0·941 | 39·30 | 46·59 | 0·889 | 62·82 | 70·35 | 0·837 | 84·48 | 89·08 |
| 9·992 | 4·62 | 5·78 | 0·940 | 39·80 | 47·13 | 0·888 | 63·26 | 70·77 | 0·836 | 84·88 | 89·39 |
| 0·991 | 5·25 | 6·55 | 0·939 | 40·30 | 47·67 | 0·887 | 63·70 | 71·17 | 0·835 | 85·27 | 89·70 |
| 0·990 | 5·87 | 7·32 | 0·938 | 40·80 | 48·21 | 0·886 | 64·13 | 71·58 | 0·834 | 85·65 | 89·99 |
| 0·989 | 6·57 | 8·18 | 0·937 | 41·30 | 48·75 | 0·885 | 64·57 | 71·98 | 0·833 | 86·04 | 90·29 |
| 0·988 | 7·27 | 9·04 | 0·936 | 41·80 | 49·29 | 0·884 | 65·00 | 72·38 | 0·832 | 86·42 | 90·58 |
| 0·987 | 7·93 | 9·86 | 0·935 | 42·29 | 49·81 | 0·883 | 65·42 | 72·77 | 0·831 | 86·81 | 90·88 |
| 0·986 | 8·64 | 10·73 | 0·934 | 42·76 | 50·31 | 0·882 | 65·83 | 73·15 | 0·830 | 87·19 | 91·17 |
| 0·985 | 9·36 | 11·61 | 0·933 | 43·24 | 50·82 | 0·881 | 66·26 | 73·54 | 0·829 | 87·58 | 91·46 |
| 0·984 | 10·08 | 12·49 | 0·932 | 43·71 | 51·32 | 0·880 | 66·70 | 73·93 | 0·828 | 87·96 | 91·75 |
| 0·983 | 10·85 | 13·43 | 0·931 | 44·18 | 51·82 | 0·879 | 67·13 | 74·33 | 0·827 | 88·36 | 92·05 |
| 0·982 | 11·62 | 14·37 | 0·930 | 44·64 | 52·29 | 0·878 | 67·54 | 74·70 | 0·826 | 88·76 | 92·36 |
| 0·981 | 12·38 | 15·30 | 0·929 | 45·09 | 52·77 | 0·877 | 67·96 | 75·08 | 0·825 | 89·16 | 92·66 |
| 0·980 | 13·15 | 16·24 | 0·928 | 45·55 | 53·24 | 0·876 | 68·38 | 75·46 | 0·824 | 89·54 | 92·94 |
| 0·979 | 13·92 | 17·17 | 0·927 | 46·00 | 53·72 | 0·875 | 68·79 | 75·83 | 0·823 | 89·92 | 93·23 |
| 0·978 | 14·82 | 18·25 | 0·926 | 46·46 | 54·19 | 0·874 | 69·21 | 76·20 | 0·822 | 90·29 | 93·49 |
| 0·977 | 15·67 | 19·28 | 0·925 | 46·91 | 54·66 | 0·873 | 69·63 | 76·57 | 0·821 | 90·64 | 93·75 |
| 0·976 | 16·46 | 20·24 | 0·924 | 47·36 | 55·13 | 0·872 | 70·04 | 76·94 | 0·820 | 91·00 | 94·00 |
| 0·975 | 17·25 | 21·19 | 0·923 | 47·82 | 55·60 | 0·871 | 70·44 | 77·29 | 0·819 | 91·36 | 94·26 |
| 0·974 | 18·08 | 22·18 | 0·922 | 48·27 | 56·07 | 0·870 | 70·84 | 77·64 | 0·818 | 91·71 | 94·51 |
| 0·973 | 18·35 | 23·10 | 0·921 | 48·73 | 56·54 | 0·869 | 71.25 | 78·00 | 0·817 | 92·07 | 94·76 |
| 0·972 | 19·67 | 24·08 | 0·920 | 49·16 | 56·98 | 0·868 | 71·67 | 78·36 | 0·816 | 92·44 | 95·03 |
| 0·971 | 20·59 | 25·07 | 0·919 | 49·64 | 57·45 | 0·867 | 72·09 | 78·73 | 0·815 | 92·81 | 95·29 |
| 0·970 | 21·31 | 26·04 | 0·918 | 50·09 | 57·92 | 0·866 | 72·52 | 79·12 | 0·814 | 93·18 | 95·55 |
| 0·969 | 22·08 | 26·95 | 0·917 | 50·52 | 58·36 | 0·865 | 72·96 | 79·50 | 0·813 | 93·55 | 95·82 |
| 0·968 | 22·85 | 27·86 | 0·916 | 50·96 | 58·80 | 0·864 | 73·38 | 79·85 | 0·812 | 93·93 | 96·08 |
| 0·967 | 23·62 | 28·77 | 0·915 | 51·38 | 59·22 | 0·863 | 73·79 | 80·22 | 0·811 | 94·28 | 96·32 |
| 0·966 | 24·38 | 29·67 | 0·914 | 51·79 | 59·63 | 0·862 | 74·23 | 80·60 | 0·810 | 94·62 | 96·55 |
| 0·965 | 25·14 | 30·57 | 0·913 | 52·23 | 60·07 | 0·861 | 74·68 | 81·00 | 0·809 | 94·97 | 96·78 |
| 0·964 | 25·86 | 31·40 | 0·912 | 52·68 | 60·52 | 0·860 | 75·14 | 81·40 | 0·808 | 95·32 | 97·02 |
| 0·963 | 26·53 | 32·19 | 0·911 | 53·13 | 60·97 | 0·859 | 75·59 | 81·80 | 0·807 | 95·68 | 97·27 |
| 0·962 | 27·21 | 32·98 | 0·910 | 53·57 | 61·40 | 0·858 | 76·04 | 82·19 | 0·806 | 96·03 | 97·51 |
| 0·961 | 27·93 | 33·81 | 0·909 | 54·00 | 61·84 | 0·857 | 76·46 | 82·54 | 0·805 | 96·37 | 97·73 |
| 0·960 | 28·56 | 34·51 | 0·908 | 54·48 | 62·31 | 0·856 | 76·88 | 82·90 | 0·804 | 96·70 | 97·94 |
| 0·959 | 29·20 | 35·28 | 0·907 | 54·95 | 62·79 | 0·855 | 77·29 | 83·25 | 0·803 | 97·03 | 98·16 |
| 0·958 | 29·87 | 36·04 | 0·906 | 55·41 | 63·24 | 0·854 | 77·71 | 83·60 | 0·802 | 97·37 | 98·37 |
| 0·957 | 30·44 | 36·70 | 0·905 | 55·86 | 63·69 | 0·853 | 78·12 | 83·94 | 0·801 | 97·70 | 98·59 |
| 0·956 | 31·00 | 37·34 | 0·904 | 56·32 | 64·14 | 0·852 | 78·52 | 84·27 | 0·800 | 98·03 | 98·80 |
| 0·955 | 31·62 | 38·04 | 0·903 | 56·77 | 64·58 | 0·851 | 78·92 | 84·60 | 0·799 | 98·34 | 98·98 |
| 0·954 | 32·25 | 38·75 | 0·902 | 57·21 | 65·01 | 0·850 | 79·32 | 84·93 | 0·798 | 98·66 | 99·16 |
| 0·953 | 32·87 | 39·47 | 0·901 | 57·63 | 65·41 | 0·849 | 79·72 | 85·26 | 0·797 | 98·96 | 99·35 |
| 0·952 | 33·47 | 40·14 | 0·900 | 58·05 | 65·81 | 0·848 | 80·13 | 85·59 | 0·796 | 99·29 | 99·55 |
| 0·951 | 34·05 | 40·79 | 0·899 | 58·50 | 66·25 | 0·847 | 80·54 | 85·94 | 0·795 | 99·61 | 99·75 |
| 0·950 | 34·52 | 41·32 | 0·898 | 58·95 | 66·69 | 0·846 | 80·96 | 86·28 | 0·794 | 99·94 | 99·86 |
| 0·949 | 35·00 | 41·84 | 0·897 | 59·39 | 67·11 | 0·845 | 81·36 | 86·61 | 0·7938 | 100·00 | 100·00 |
| 0·948 | 35·50 | 42·40 | 0·896 | 59·83 | 67·53 | 0·844 | 81·76 | 86·93 | | | |

Based on figures of
O. Hehner

AMOUNT OF ETHYLIC ALCOHOL BY VOLUME IN VARIOUS LIQUORS.

| | | | |
|---|---|---|---|
| Whiskey ... ... | 51 – 59% | White wine ... ... | 12 – 14% |
| Rum ... ... ... | | Champagne ... ... | 10 – 13% |
| Gin ... ... ... | | Orange Wine ... ... | 10 – 12% |
| Strong Liqueurs ... | | Burgundy ... ... ... | 9 – 12% |
| Proof Spirit ... ... | 57% | Hock ... ... ... | 9 – 12% |
| Brandy ... ... ... | 43 – 57% | Claret ... ... ... | 8 – 12% |
| Port ... ... ... | 20 – 30% | Cider ... ... ... | 5 – 9% |
| White Wine (strong) | 23 – 29% | Strong Ale or Stout ... | 5 – 9% |
| Sherry ... ... ... | 16 – 22% | Beer and Porter... ... | 2 – 5% |
| Madeira ... ... ... | 16 – 22% | | |

HALE WHITE.

## ALDEHYDUM FORMICUM.

*Formalin as Preservative* :—

By the **Linley Process** meat is sterilised by placing in "Chilling Rooms" and then to every cubic foot of space in the chamber at 50° to 60° F. a fan distributes 1 ounce of Formalin. This acts on the meat, which is finally frozen for shipment at 32°F.

The Local Government Board issued a report by Buchanan and Schryver on use of Formaldehyde and Paraform for meat preservation. Of the former a mixture of Glycerin, Salt and Formalin is used. Paraform is volatilised in ship holds to kill mould not stopped by the cold. Can be detected in the meat. Recommendation to limit use to sanitary disinfection before meat is introduced.—C.D. ii./09,343.

The process remains under careful observation and in present circumstances it does not seem necessary to take steps to prohibit its use. —L. i./10,833.

For Milk, etc., *see* Milk Analysis, p. **188**.

**Determination of Formaldehyde**—4 to 4½ Gm. of the solution (if about 40%) is accurately weighed into a stoppered flask of 150 to 200 Cc., about 50 Gm. of Ammonium Chloride in fine powder are next added and then 25 Cc. of a double Normal Solution of Caustic Soda,—flask is shaken meanwhile. Contents and flask are allowed to cool down to temperature of room, then 50 Cc. of Water, containing 4 drops of 1% Solution of Methyl Orange are added and titrated with Normal Sulphuric Acid. The number of Cc. of Normal Soda used, multiplied by 0.06 gives the weight of Formaldehyde. If the solution be acid another portion is titrated with decinormal alkali and phenolphthalein and the necessary correction made in the amount of Soda neutralised.—P.J. i./11,433. Other methods P.J. ii./08,840 (Colorimetric), ii./10,637, 881. Am. Jl. Ph., Oct. 1911, 455; *c.f.* also Estimation in Lysoform.

The Iodine method of estimation is unsafe when the H COH content is quite unknown. The following 'standardised' method is said to be satisfactory. Employ 20 Cc. 2 N. NaOH per 0·25 Gm. H. COH, then add slowly 50 Cc. $\frac{N}{5}$ I. Shake and allow to stand one minute; then acidify and titrate with Thiosulphate.—Evans' Anal. Notes, 1911.

## ARGENTUM.

**Argentic Hair Dye** (Black or Brown).

No. 1 Solution.—Silver Nitrate 1, Distilled Water to 12.

No. 2 Solution.—Sulphurated Potash 1, Distilled Water to 8. After washing and drying the hair, the solutions to be applied separately, in above order, and after 2 minutes the hair well washed with rain water. this dyes brownish black with one application, but lighter shades may be obtained by using a weaker strength of No. 1 solution, which should not be allowed to touch the skin.

**Pyrogallol Hair Dye** (Black).

No. 1 Solution.—Pyrogallic acid 1, Alcohol (90%) 8, Distilled Water 40. Apply before No. 2.

No. 2 Solution.—Silver Nitrate 1, Strong Solution of Ammonia 1, Distilled Water to 8. Use as last.

This dyes grey hair *jet black* with one application.

Various other formulæ for "Silver Hair Dyes"—modifications of the above, *e.g.*, using a small addition of Sodium Metabisulphite in the No. 1 solution have been tried producing analogous result, but the difficulty about these preparations is that they simultaneously stain the *skin*.

**Copper Pyro Hair Dyes** (Odorless).

Light Brown.—Cupric Chloride ($CuCl_2+2H_2O$) and Pyrogallol of each 1, Water 100.

Dark Brown.—Cupric Chloride 1, Ferric Chloride 0.5, Pyrogallol 1.5, Water 100.

Black.—Cupric Chloride 0.6, Ferric Chloride 2, Pyrogallol 2, Water 100. This produces a fairly natural tint.

**Amidol Hair Dye** (Black). Amidol, 80 grains. Sodium Sulphite, 120 grains. Alcohol 10%, 1 ounce.

A large number of experiments conducted, April, 1911, to determine the best *black die that shall not stain the skin* showed that this Amidol formula stands first. With this dye the colour develops gradually, the excess of the solution dabbed on in the ordinary way can be slightly washed out, leaving the hair dark brown, but to produce a black several successive applications may be necessary. In our experiments we find that grey hair so dyed will stand vigorous washing with soap and water without appreciably affecting the colour.

*It will not stain the skin* if carefully applied. It did not appear to rot the hair. The freer the hair is from grease—even the natural grease of the scalp—the quicker the action A difficulty with regard to the solution is that it deposits the colouring on the side of the bottle.

The Amidol Dye is based on the formula in Pharm. Formulas, page 124, being double strength. The ordinary strength of Pharm. Form. gives a brown stain as stated. It has the advantage of being odorless and a *one* solution dye.

Next in order of merit in our opinion, came the "Argentic." It stains the skin if left on, but if washed off as soon as used it does not.

## ARSENIUM.

**Horticultural Use.**—Method of applying wash, spray, and paste.—P.J. ii./08,722.

**Detection of Arsenic in Drugs.**—The Pharmacopœia Committee of the General Medical Council recommend the following for insertion in Appendix III. of the B.P. in place of the present remarks on arsenium.

A solution of 4 Gm. of the drug is to be prepared as described in a series of special notes, and is to be diluted with water to a volume of 25 Cc. This solution is to be placed in a test tube of about three-quarters of an inch (about 2 Cm.)

in diameter and 7 inches to 8 inches (18 to 20 Cm.) in length. Fragments of **granulated zinc are to be put into the test tube** until they reach to about two-thirds of the height of the liquid. Immediately after adding the zinc a small plug of cotton-wool is to be placed in the test tube above the liquid, and then a plug of **plumbised cotton-wool**, so as to leave a short space between the two plugs, and a closely fitting cap formed of two mercurialised test papers to be fastened on; it must not be torn at all when fastened on the test tube. The test is to be allowed to continue for two hours at least, and the test paper is to be examined by daylight for a yellow stain. The test should be conducted in a place protected from strong light. It is applicable both in the case of arsenious and arsenic compounds. For comparative purposes the stain given by 0·012 milligramme of arsenium is utilised.

***Limit of Arsenical Contamination.***—The present limit of arsenium in the B.P. is taken at 3 parts per million; this proportion might for the drugs given in small doses be adopted as the limit. It is equivalent to $\frac{1}{36}$ grain white arsenic per pound. The limit for tartaric and citric acids, which are largely used in foods and drinks, is placed at $\frac{1}{100}$ grain of arsenious oxide per pound, *i.e.*, 1·08 of arsenium per million, *c.f.* also p. 13.

This limit is confirmed by McFadden's Report to Local Government Board.—B.M.J. ii./07,1140.

In sulphuric, nitric and hydrochloric acids the limit of $\frac{3}{10}$ths of one part per million of arsenium is recommended, and for solution of ammonia so small a content as $\frac{1}{10}$ is attainable.—P.J. ii./04,373, 424, 807; C.D. ii./04,434.

**Bettendorf's Reagent** for arsenic is a concentrated solution of stannous chloride in hydrochloric acid. A colourless arsenical solution will deposit brown metallic arsenic in the cold or on warming.

**Gutzeit's Test.** The substance to be examined is placed in a test tube with some arsenic-free zinc and sulphuric acid. The tube is plugged with cotton wool, and covered with filter paper having a spot of silver nitrate solution. A yellowish stain resulting in a few minutes indicates presence of arsenic. A control with lead acetate paper should be conducted to obviate confusion with sulphur.

A modification of the test consists in employing alkali instead of acid for generating the hydrogen and using a spot of mercuric chloride as in the B.P. Test for arsenic in glycerin.

U.S. fixed limit of impurity for arsenic and heavy metals at 1 in 100,000, and employs this test modified for the former.

**Modified Apparatus for Gutzeit's Test.** Four ounce wide mouth bottle, fitted with I.R. cork and glass tube 200 mm. long and internal diameter 5 mm., open at both ends, the lower end drawn out with small hole about 1 Cm. from end at constriction. This arrangement allows condensed water to drip back into bottle while providing free upward passage for the gas. Roll of lead paper 10 Cm long prepared with 10% solution of lead acetate and subsequently dried and pushed into tube so that upper end is 2 Cm. from top of tube. Cap of mercuric chloride soaked filter paper (5·5 Cm. in diam.) fits over top in ordinary manner. The hydrochloric acid used should contain small percentage of stannous chloride to assist in gas evolution and to reduce arsenic to the "ous" state. Also to make results comparable with the standard, which is arsenious anhydride in hydrochloric solution, strength 1 Cc.=0·00001 Gm. Stannous chloride is made by diluting the B.P. solution with equal volume of hydrochloric acid and boiling to eliminate arsenic completely. Filter and make up to original strength. One per cent. of this is added to the strong hydrochloric acid employed in the tests. Use 10 Cc. of the acid (containing 1% stannous chloride solution), 50 Cc. water and 10 Gm. zinc. $\frac{1}{500}$th milligram of arsenium calculated as arsenious oxide gives distinct yellow stain, *i.e.*, one part in 5,000,000 can be detected and estimated. In the estimation of iron compounds distil the arsenious chloride after reducing to the "ous" condition. After dissolving, *i.e.*, in hydrochloric acid and potassium chlorate, add stannous chloride drop by drop to reduce completely, as seen by the yellow colour of the solution being discharged.—C. D. ii./05,548; P.J. ii./04,500.

Method of employing arsenic-free ammonium chloride and magnesium powder produces a constant stream of arsenic free hydrogen. The compound MgCl.OH is formed. Mercuric bromide is more sensitive than mercuric chloride. — P.J. i./06,555.

**Marsh's Test** consists in generating hydrogen by means of pure acid and zinc, and to these is added the substance to be tested. If arsenic be present arseniuretted hydrogen is evolved, which deposits metallic arsenic in the cooler parts of the delivery tube, which is heated at several points by aid of Bunsen burners.

The addition of a little copper sulphate gave a mirror with only 0·0001 mgr. of arsenic, whereas platinic chloride (the customary addition to activate) only showed presence with 0·001 Mg.—P.J. ii./06,325.

**Reinsch's Test** consists in introducing copper to a hydrochloric solution. Cuprous chloride and hydrogen are formed. The latter reduces the arsenite to hydride; this reacts with the cuprous chloride, giving hydrochloric acid and depositing copper arsenide on the strip of metal employed.

Urine containing arsenic, methods of detection.—P.J. ii./08,402.

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## ORGANIC ARSENIC COMPOUNDS.

### *To test the purity of Sodium Arsanilate.*

Apart from estimation of arsenic contents *c.f.* Table p. 23 and determination of water of crystallisation, it may be mentioned that precipitation with Silver Nitrate is of little use to indicate arsenate as impurity. From our experiments it will not show more than 0.5% by color of the precipitate.

Sodium Arsanilate in Marsh apparatus is reduced, yielding usual black stain on porcelain.

***To detect Arsenate*** as impurity in Sodium arsanilate we found after experimenting that the best mode of proceeding is to dissolve 0.5 Gm. in 2 Cc. Hypophosphorous Acid, warming and diluting to 10 Cc. with water, then add 5 drops Hydrochloric Acid, pass $H_2S$ through the liquid. and warm slightly alternately. A bright orange yellow pp. will form rapidly if 0.1% Sodium Arsenate be present as impurity (W.H.M.).

### ESTIMATION OF ARSENIC IN ORGANIC SUBSTANCES.

Several methods are provided in a paper by the author on "Organic Arsenic Compounds." Int., Cong., 1909. The following is simplest (arranged by the Author), and gives good results: Powder the substance carefully, mixing with about equal quantity of potassium nitrate, moistening with water, then oxidise with nitric acid, taking up the dried material with acetic acid, adding sodium acetate solution, and titrating with Standard Uranium Acetate Solution 1 C.c. = 0.0053 gram arsenium. For example 0.464 gram Arsamin required 20·2 C.c. uranium solution = 0·10706 gram arsenium = 23·08 per cent. (theory with $4\frac{1}{2}H_2O$ = 23·4 per cent.)

P.G.V. gives the following for Sodium Arsanilate or the acetylated body:—0·2 Gm. is placed in a 100 Cc. Jena flask with a long neck, 10 Cc. of sulphuric acid and 1 Cc. of fuming nitric acid are added, and the mixture boiled for one hour. On cooling, 50 Cc. of water are added and then evaporated; this procedure is carried out twice. To the cold solution 10 C.c of water are added, and a solution of 2 Gm. of potassium iodide in 5 Cc. of water, and sufficient water to dissolve the precipitate. After standing for half an hour it is titrated (without using an indicator) with N/10 sodium thiosulphate. 1 Cc. of this corresponds to 0·003748 Gm. As.

We have not applied either of these methods to Salvarsan.

### Salvarsan.

#### Chemistry of the Injections

The reaction which takes place on bringing sodium hydrate sufficient to neutralise in contact with dioxy-diamino-arsenobenzo-hydrochloride may be indicated thus:

$$\begin{aligned} &C_{12}H_6As_2(NH_2)_2(OH)_2(HCl)_2 + 2NaOH \\ &= C_{12}H_6As_2(NH_2)_2(OH)_2 + 2NaCl + 2H_2O. \end{aligned}$$

*i.e.* approximately :—

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 438.972 | Gm. require | 2000 | Cc. | N/$_1$NaOH | = | 455.9316 | Cc. | of 15% | w/w NaOH. | | |
| 0.3 | ,, | 1.37 | ,, | ,, | = | 0.312 | ,, | ,, | ,, | or 5 | minims |
| 0.4 | .. | 1.82 | ,, | ,, | = | 0.416 | ,, | ,, | ,, | ,, 7 | ,, |
| 0.5 | . | 2.28 | ,, | ,, | = | 0.519 | ,, | ,, | ,, | ,, 8 | ,, |
| 0.6 | .. | 2.73 | ,, | ,, | = | 0.623 | ,, | ,, | ,, | ,,10 | ,, |
| 0.7 | ,, | 3.19 | ,, | ,, | = | 0.727 | ,, | ,, | ,, | ,,12 | ,, |

We see from the above that the **basic substance** is formed and may be precipitated from solution.

By the use of *half the amount of* Sodium Hydrate in the above it will be evident that a body of the formula $C_{12}H_6As_2(NH_2)_2(OH)_2HCl$ the **Monohydrochloride** can be formed.

Again, it is possible to replace one or two Hydrogen atoms of the Phenolic Hydroxyls (after saturating the HCl radicals), producing Mono- and Di-Sodium compounds as follows :—

$$\begin{aligned} &C_{12}H_6As_2(NH_2)_2(OH)_2(HCl)_2 + 3NaOH \\ &= C_{12}H_6As_2(ONa)(OH)(NH_2)_2 + 2NaCl + 3H_2O \end{aligned}$$

In this instance of the Di-hydrochloride :—

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 3 | Gm, | requires | 2.05 | Cc. | N/$_1$NaOH | = | 0.467 | Cc. | of 15% | w/w NaOH | or | 8 | minims. |
| 0.4 | ,, | ,, | 2.73 | ,, | ,, | = | 0.624 | ,, | ,, | ,, | ,, | 10 | ,, |
| 0.5 | ,, | . | 3.42 | ,, | ,, | = | 0.779 | ,, | ,, | ,, | ,, | 13 | ,, |
| 0.6 | ,, | .. | 4.10 | ,, | ,, | = | 0.934 | ,, | ,, | ,, | ,, | 15 | ,, |
| 0.7 | ,, | ,, | 4.78 | ,, | ,, | = | 1.090 | .. | ,, | ,, | ,, | 18 | ,, |

to produce the **Mono-Sodium** Compound.

The Mono-Sodium Compound is the first stage after the precipitation of the base in making solutions for injection; for example, 0.6 Gm. with 4.1 Cc. Na.OH solution and the requisite water produces an almost clear solution. The addition of another 1.4 Cc. makes the soluble Di-Sodium Compound :—

$$\begin{aligned} &C_{12}H_6As_2(OH)_2(NH_2)_2(HCl)_2 + 4NaOH \\ &= C_{12}H_6As_2(ONa)_2(NH_2)_2 + 2NaCl + 4H_2O \end{aligned}$$

*i.e.*, of the Di-hydrochloride approximately.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 3 | Gm. | requires | 2.73 | Cc. | N/$_1$NaOH | = | 0.623 | Cc. | of 15% | w/w NaOH | or | 10 | minims. |
| 0.4 | ,, | ,, | 3.64 | ,, | ,, | = | 0.831 | ,, | ,, | ,, | ,, | 14 | ,, |
| 0.5 | ,, | ,, | 4.56 | ,, | ,, | = | 1.038 | ,, | ,, | ,, | ,, | 17 | , |
| 0.6 | ,, | ,, | 5.47 | ,, | ,, | = | 1.246 | ,, | ,, | ,, | ,, | 21 | ,, |
| 0.7 | ,, | ,, | 6.38 | ,, | ,, | = | 1,454 | ,, | , | , | ,, | 24 | ,, |

to produce **Di-Sodium Compound**.

**Reaction of Solutions used in Injection and attendant pain.**

We have always attributed some at least of the untoward results from the substance and the pain produced to faulty technique.

For **Subcutaneous** injection the neutral suspension has been mostly used. Pain produced by this would be mostly attributable to the fact of injection of a magma of unstable precipitate—which would be only slowly broken up.

Undue acidity or alkalinity would naturally tend to produce pain and inflammation. Faintly acid injections are neutralised by the blood plasma which is met in the tissues.—B.M.J.E. i./11,15, 16.—*Cf.* notes under Intravenous Injection.

In our book 'Salvarsan' we give a critical survey of the reaction of all the various solutions advised by the early workers—some were marked alkaline.

### Blood Examination.

Blood examinations show leucocytosis after injection in some cases. May be as high as 30,000. Usual count is about 17,000 (McDonagh). See also Pernicious Anæmia *Vol. I.* p. 181.

### Examination for Spirochetes.

The spirochetes are stated to disappear from the blood in about 24 to 48 hours after injection. but it may take considerably longer, *e.g.*, up to 14 days.

An experimental comparison (using rabbits) between "606," Mercuric Iodide and Potassium Iodide as antisyphilitics: Salvarsan was the most marked spirochæticide, Potassium Iodide found to be not a direct antisyphilitic.—L. ii./11,940.

### What happens to the Spirochetes?

Various theories seem to find credence amongst authorities on the subject.

Erhlich has stated that "606" kills the spirochetes and the dead spirochetes liberate a protein which stimulates the production of a syphilitic antibody, and that on the extent to which this is effected the cure of syphilis depends.

McDonagh says parasitotropic substances act partly by killing the parasite and partly by liberating the chemical substances contained in the bodies of the parasites which kill off the remainder. That Salvarsan acts in this way is shown by the fact that larger doses are required to heal an early case with a primary sore, than a late case with gummata. Again the cure of infants from infected mothers by injection of the latter (no Arsenic passing by the milk) is also in support of this view.—B.M.J. ii./10,1261.

Another authority says that the spirochetes become broken up into bead-like bodies or pieces by the action of the chemical—this at any rate in vitro. The spirochetes can be found in teeming numbers in a chancre before the injection, whilst the day after the injection they will have absolutely disappeared.

A pharmacologist writes:—"The parasites in the case of Salvarsan and Sodium Arsanilate, are able to break up the molecule and so liberate the arsenic in ionic form—such ionic arsenic is very toxic to protozoa. Suggestion is made that an Organic Mercury Compound might also work well on bacteria on analogous lines.—P.J. ii./11,16.

Another opinion is that it is too premature to say whether the effect consists in destruction of the whole or part of the parasites or simply in suppression of their activity.'—L. i./11 731

## Carbolic Acid Co-Efficient.

We conducted some experiments to determine, if possible, the Carbolic Acid Coefficient of Salvarsan by the "*Lancet*" method. The solution was prepared as for intravenous injection, this being the only practical way of operating. The results were most anomalous, *e.g.*, we obtained :—

(1) No growth in 1 in 200 dilution with 2 and 30 minutes' contact.
(2) Growth in 1 in 200 ,, ,, 2 ,, 30 ,, ,,
(3) Growth in 1 in 100 ,, ,, 2 ,, 30 ,, ,,
(4) No growth in 1 in 100 ,, ,, 2 ,, 30 ,, ,,
(5) Growth in 1 in 80 ,, ,, 2 ,, 30 ,, ,,
The investigation was therefore not pursued further.

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The following figures have been calculated showing the actual Arsenic content of some of these bodies. Their Solubilities have also been determined in a number of cases.

| ARSENIC COMPOUND AND FORMULA. | Molecular Wts., employing International 1912 Atomic Wts. | Arsenic content per cent. | SOLUBILITIES. | |
|---|---|---|---|---|
| | | | Water. | Alcohol 90% |
| Acid, Arsenic, $AsO(OH)_3$. ... ... ... | 141·984 | 52·8 | 2 in 1 | Very |
| Acid, Cacodylic, $(CH_3)_2 AsO.OH$. ... .. | 138·016 | 54·3 | 2 in 1 | 1 in 4 |
| Cacodyle, $(CH_3)_2 As-As(CH_3)_2$. ... .. | 210·016 | 71·4 | | |
| Cacodyle Oxide $(CH_3)_4 As_2O$. ... .. | 226·016 | 66·3 | | |
| Sodium Cacodylate $[(CH_3)_2 AsO.ONa3H_2O$. ... ... .. | 214·056 | 35·0 | 2 in 1 | About 1 in 1 |
| Magnesium Cacodylate $[(CH_3)_2 AsO_2]_2Mg$. ... ... ... .. | 298·336 | 50·25 | 1 in 3 | Insoluble |
| Iron Cacodylate $[(CH_3)_2 AsO_2]_3 Fe$. ... | 466·864 | 48·17 | 1 in 15 | Insoluble |
| Guaiacol Cacodylate, $(CH_3)_2AsO.OH.C_6H_4.OH(OCH_3)$. ... | 262·080 | 28·6 | 1 in 25 | 1 in 1·5 |
| Acid, Ethyl-cacodylic (diethyl-arsinic), $(C_2H_5)_2AsO.OH$. ... ... ... | 166·048 | 45·1 | | |
| Acid, propyl Cacodylic, $(C_3H_7)_2AsO.OH$. .. | 194·080 | 38·6 | | |
| Di-sodium Methylarsenate (Arrhenal) $CH_3AsO.(ONa)_2H_2O$. ... ... ... .. | 202·0 | 37·1 | 1 in 1 | Slightly |
| Quinine Arrhenalate, $C_{20}H_{24}N_2O_2CH_3AsO.(OH)_2$ ... ... ... ... ... .. | 464·212 | 16·1 | | |
| Acid, Di-iodo Methylarsonic $CHI_2AsO(OH)_2 H_2O$ ... ... ... ... | 409·840 | 18·2 | 1 in 10 | 1 in 10 |
| **Sodium Di-iodo Methylarsonate** $CHI_2AsO(OH).ONaAq$. (on anhydrous salt .. ... ... ... ... ... | 413·816 | 18·1 | 1 in 1 | Slightly |
| Acid, Tetra-iodo Cacodylic$(CHI_2)_2AsO.OH$. | 641·664 | 11·7 | Insoluble | 1 in 600 |
| **Sodium Tetra-iodo-Cacodylate** $(CHI_2)_2AsO.ONa.6H_2O$. ... ... ... | 771·752 | 9·7 | 1 in 2 | Slightly |

| ARSENIC COMPOUND AND FORMULA. | Molecular Wts. employing International 1912 Atomic Wts. | Arsenic content per cent. | SOLUBILITIES. | |
|---|---|---|---|---|
| | | | Water. | Alcohol 90%. |
| Magnesium Ethyl Arsonate, $MgAsO\,C_2H_5O_2$ | 176·32 | 42·5 | Very slightly | Almost insoluble |
| *n*-Propyl-arsonic Acid. $C_3H_7,AsO(OH)_2$. ... | 168·032 | 44·6 | | |
| Magnesium Propyl Arsonate $C_3H_7AsO.O_2Mg$. ... ... ... ... | 190·336 | 39·4 | Pract. insoluble | |
| *p*-**Tolyl-Arsonic Acid,** $CH_3C_6H_4AsO(OH)_2$ ... ... ... ... ... .. | 216·032 | 34·7 | Slightly (more so hot). | Slightly |
| *p*-Amino-phenyl-Arsonic Acid. $NH_2C_6H_4AsO(OH)_2$ (Arsanilic Acid) ... | 217·034 | 34·5 | Slightly | |
| **Sodium-*p*-amino-phenyl Arsonate** $NH_2C_6H_4.AsO.OH.ONa.5H_2O$. ... ... | 329·106 | 22·8 | | Slightly |
| Ditto Ditto $+4\frac{1}{2}\ H_2O$. ... | 320·098 | 23·4 | | |
| Ditto Ditto $+4\ H_2O$. ... | 311·090 | 24·09 | 1 in 6 | About |
| Ditto Ditto $+3\ H_2O$. .. | 293·074 | 25·6 | About | 1 in 125 |
| Ditto Ditto Anhydrous. | 239·026 | 31·4 | | |
| **Mercury Atoxylate** $(NH_2C_6H_4AsO.OH.O)_2Hg$. ... ... ... | 632·652 | 23·7 | Insoluble | |
| **Sodium Acetyl-*p*-Amino-Phenyl-Arsonate.** $CH_3CO.NH.C_6H_4AsO.OH.ONa.5H_2O$ ... | 371·122 | 20·2 | 1 in 10 | Insoluble |
| Sodium 3 Methyl 4 Acetyl-*p*-Amino-phenyl Arsonate. $CH_3CONH.C_6H_3CH_3.AsOH.O.ONa$ ... | 295·058 | 25·4 | 1 in 4 | 1 in 1000 |
| Dimethyl-amino-phenyl-arsonic Acid. $(CH_3)_2N.C_6H_4AsO.(OH)_2$ ... ... ... | 245·066 | 30 6 | Almost insoluble | Almost insoluble |
| **Sodium Dimethyl-Amino-Phenyl-Arsonate.** $(CH_3)_2N.C_6H_4AsO.OH.ONa.5H_2O$. | 357·138 | 21·0 | 1 in 14 (more in hot). | Slightly (more if hot). |
| **Acid Di-camphoryl-arsinic.** $(C_{10}H_{15}O)_2AsO.OH$. ... ... ... ... | 410·208 | 18·3 | Hardly. 1 in 5 | Easily. 1 in 12 |
| **Dioxy-diamino-arsenobenzol Dihydrochloride** $C_{12}H_{12}O_2N_2As_2(HCl)_2$ | 438·972 | 34·15 | | |
| Sodium Benzo-sulpho-*p*-amino-phenyl Arsonate $C_6H_5.SO_2.NH.C_6H_4.As.O.OH.ONa$. ... | 379·128 | 19.77 | Very soluble | Very soluble |

## BISMUTHUM.

### Liquor Bismuthi et Ammonii Citratis.

The precipitate by B.P. method of making should be washed rapidly without unnecessary exposure. Sterile materials and utensils should be used. The potassium citrate must be pure, and the solution of ammonia must be quite free from tarry matter. Test for the latter by adding 2 to 3 Gm. of copper sulphate to the ammonia solution until it smells very slightly of ammonia; tar constituents will colour it.—C.D. i./05,708.

If the quantity of potassium carbonate in the official formula be increased by $\frac{1}{3}$, the washings from the precipitate are almost neutral, and the loss of bismuth is considerably less. It is even better to work with the crystalline bismuth nitrate, using necessarily increased quantity of alkali.

N.B.—Experiments conducted by us to determine the best method of preparing Liquor Bismuthi showed that the *B.P.* 1885 *method is best*,—keep the Liquor in small stoppered bottles (full) or make with Chloroform Water 1 in 400 (Chloroform is a good preservative). It is important that the Bismuth Citrate should be pure. The 1898 B.P. method is satisfactory, but is, of course, a longer process. For further details of our experiments (*vide* Edn. XIV., p. 184.)

*C.R* 1911.—Citric Acid 26 is powdered and mixed in a mortar with Bismuth Subnitrate 35 and Distilled Water 10, allow the mixture to stand with occasional stirring for half-an-hour or until a small portion is completely soluble in Solution of Ammonia. Transfer to a flask using 200 of Distilled Water to rinse the mortar:—Allow the Bismuth Citrate to settle, decant the clear liquid and wash with three successive quantities of 200 of Distilled Water. Add to the moist Bismuth Citrate just sufficient Solution of Ammonia to form a clear solution and dilute to 500 by volume. Estimation of Bismuth as oxide should be substituted for that of Sulphide. 10 Cc. should yield not less than 0·5 Gm. of Bismuth Oxide.

R. C. Cowley gives directions for preparing a neutral Ammonium Bismutho-Citrate—a modified form of that published in P.J. and C.D. Dec. 23, 1899—Precipitated Bismuth Citrate acts as a monobasic acid which can be quantitatively estimated with Ammonia Solution,—using Litmus as indicator—in this way a neutral Liquor Bismuthi can be made. It forms a clear solution with Sodium Bicarbonate (Commercial Liquor containing free Ammonia converts Bicarbonate to Carbonate,—the latter then precipitates Bismuth as Carbonate)—C.D. i./11,314.

## BISMUTHI SALICYLAS.

Suggested test for new B.P.—5 Gm. treated with 30 Cc. of dry ether to yield not more than 0·005 Gm. Salicylic Acid.—*C.R.* 1908.

Rectified Benzol as extractive. If allowed to percolate through the sample and the liquid be dropped into dilute Ferric Chloride Solution, this will detect the smallest quantity of free Acid by violet colouration at junction of the two liquids.—P.J. ii./08,404. Alcohol decomposes, and Ether and Chloroform are unsuitable.—P.J. i./09,3. Harrison found Ether best for extracting. A true Bismuth Salicylate and a loose combination of base and acid are on the market.—P.J. ii./09, 131,156; C.D. ii./09,184.

## BISMUTHI SUBNITRAS.

**Dragendorff's Test for Alkaloids.**—Bismuth Subnitrate 8, Nitric Acid, Sp. Gr. 1·18, 20; add this solution gradually to a concentrated solution of Potassium Iodide 22·7. Cool, decant from Potassium Nitrate formed and dilute to 100 with water. The solution precipitates most alkaloids.

A suggested modification.—Dissolve Bismuth Carbonate 64 in Hydrochloric Acid 85 and add Water 500 containing Potassium Iodide 166. Finally make up with Water to 800. This eliminates Nitric Acid which causes decomposition, and the proportion of Potassium Iodide is less. With this formula there is not the trouble with the crystals of Potassium Nitrate.

## BROMUM.

### New Method of Bromination with Aqueous Hypobromous Acid.

The use of hypobromous acid, prepared by digesting bromine and $H_2O$ with excess of HgO, in the form of a straw-yellow solution containing about 6.2% of Br., is suggested as a brominating agent. It suffices to shake this in the cold with $C_6H_6$; $C_6H_5CH_3$, or $C_6H_5COOH$ to obtain satisfactory yields of monobromobenzene, *o*-and-*p*-bromotoluene, *m*-bromobenzoic acid. Aniline yields tribromaniline; phenol gives tribromophenol under similar conditions; nitrobenzene resists bromination, as also does phthalic acid.—J.C.S.A. i./10,234.

## CAFFEINA.

ESTIMATION OF CAFFEINE IN PRESENCE OF ACETANILIDE, *e.g.*, in headache powders: extract from a sulphuric acid solution with Chloroform.

Precipitate with iodine and decompose the periodide with sodium sulphite, and extract the base again with chloroform.—C.D. ii./04, 469.

Caffeine hinders germination of seeds.—L. i/12, 666.

**Maté.—**

Analysis showed Caffeine 2·02%, Sugar as Glucose 6·08%, Tannin 11·22%—3 and 10 minutes infusion (the 10 minutes being on the old mare) at about 90° gave total dissolved substances respectively 21.8%, 31.8%, organic matter 19·4%, 28·4%. Mineral Matter (Ash) 2.4%, 3%, Tannin 7.68% 11·08% and Caffeine 1·39% and 1.70%. The second figures in each case indicating totals. The best method of preparing the 'Tea' is by first moistening the leaf thoroughly with boiling water, and then after a few minutes, adding the remainder of the boiling water and allowing to infuse for 15 minutes.—P.J. i./10,787.

An attempt to again introduce Maté into Europe. It would be preferable to the alcohol which threatens to destroy us.—C.D. i./11,53. A mild heart stimulant if taken periodically. Leaving it off after having taken it for some time may cause prostration.—P.J. i./11,3 Mortality from heart disease in Argentine is greater than elsewhere—ascribed to Maté. Test for distinguishing between Infusions of Tea and Maté—P J. i/12 ,125.

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## CALCII CHLORIDUM.

With regard to the possible danger of the Chloride clotting the blood, Sir J. Barr refers to **Blair Bell's Calcimeter,** *i e.* **an Apparatus for estimating the proportion of Lime Salts in the blood,** urine and other fluids. Such estimation may show lime in excess, and suggest the use of Citric Acid.—B.M.J. i./07,717.

The *method* consists in counting the Calcium Oxalate crystals formed by mixing a known volume with Oxalic Acid.

250 c.mm. of an Aqueous Solution of Oxalic Acid (1 in 30) are mixed with 100 cm.m. of blood. After time has elapsed for the Calcium and Magnesium to be combined, 250 c.mm. of a mixture composed of Acetic Acid (1%) 95 parts and Glycerin 5 parts are added—this disolves Magnesium Salts. Add 100 c.mm. of the mixture to 500 cm.m. of water. A drop of this final dilution is counted on a Thoma-Zeiss Cell. Count the number of crystals in 250 squares—1 crystal per square gives the Calcium Index 1.

The normal healthy maximum is now thought to be 0.8.—Sir James Barr, B.M.J. ii./10,830.

Some observations seem to indicate that pregnancy is terminated when the fœtus ceases to absorb or receive Calcium Salts from the mother's blood and a large accumulation occurs in her system.

**Blair Bell's Solutions.** In addition to the above the following is contributed :—**Calcium Estimation in urine and blood.**—The lime is thrown out by a **Reagent** consisting of a Saturated Solution of Oxalic Acid in 5% Solution of Acetic Acid. Comparing results produced with a **Standard Solution** of Calcium Phosphate $Ca_3(PO_4)_2$—prepared by dissolving 0·05 Gm. in a little Hydrochloric Acid, making alkaline with Ammonia and then acid with Acetic Acid. Finally 2 Gm. of Urea are added and the whole diluted to 100 Cc. Sp. Gr. of the product is about 1015.—B.M.J. i/12, 578.

**Apparatus for coagulability determinations.** In the puerperal state the coagulation time immediately after delivery is below normal. Determination of the time might prove useful after delivery to indicate risk of thrombosis or embolism if the time be low, or of post-partum hæmorrhage if high. Treatment as above could then be employed.—L. i./08,99.

The method from chemical standpoint is said to be an excellent one clinically. Some connexion between thyroid gland secretion and Calcium metabolism, also intimate connexion between pituitary extract and Calcium metabolism—under the influence of the extract there is an increase of Calcium. Adrenal Extract causes Calcium retention. The ovaries influence Calcium metabolism (osteomalacia has been cured by oophorectomy and Calcium retention occurs after the menopause). The ductless glands more than probably preserve a balance in the Calcium metabolism—one acting anabolically, another katabolically. Subsequent papers to indicate more fully the connexion existing between these glands and the functions of the female genital apparatus.—B.M.J. i./09,517.

In most cases of exophthalmic goitre (thyroid secretion in excess) the Calcium index was low, hence administration of Calcium salts may be advantageous.

Further work on the subject of menstruation gave *inter alia* the conclusion that menstruation is a periodic function only in so far as the Calcium metabolism is in harmony with this periodicity, and that the function is dependent on Calcium metabolism in all its ramifications.—B.M.J. i./09,592.

Ammonium Oxalate prevents coagulation of the blood by precipitating Calcium, the presence of which is thought to be essential to coagulation.—P.J. ii./06,657.

**Calx Chlorinata.**—According to recent views, when moist $CO_2$ acts on bleaching powder Chlorine only is given off (no Hypochlorous Acid as originally taught). Air free from $CO_2$ very slowly liberates Hypochlorous Acid, but no Chlorine. With air containing $CO_2$ a mixture of Hypochlorous Acid and Chlorine is obtained, the proportion of the former decreasing with time. These points are explained on assumption that the action of Chlorine on alkalis is reversible.

$$2Ca(OH)_2 + 2Cl_2 \leftrightarrows Ca(OCl)_2 + 2H_2O.$$

The action of air in promoting bleaching is therefore due to removal of Lime from the powder by $CO_2$.—P.J. ii./10,584. The bleaching action is further accelerated by the addition of Common Salt or Calcium Chloride.

## CANTHARIS.

Gaze's Assay process for galenical preparations of the drug: 50 Cc. of (for example) the tincture is evaporated to dryness with 25 Cc. of water and 1 Cc. of a 30% solution of Sodium Carbonate. The residue is taken up with 10 Cc. of water and 2 Cc. of 25% hydrochloric acid, the liquid transferred to a small separator and extracted with four separate portions of 10, 5. 5, and 5 Cc. of chloroform. The chloroform is evaporated at a low temperature, and the residue allowed to stand at ordinary temperature for twelve hours. It is then treated with two successive small portions of petroleum ether, each being poured on to a small filter, the residue and the filter washed first with water containing a trace of ammonium carbonate, then with pure water, and then dried at 50°. The portion remaining undissolved in the flask is treated with warm acetone, which is passed through the filter, which is further washed with acetone, and the brownish residue is dried on a water-bath to constant temperature and weighed. ("Apotheker Zeitung," 1911, p. 332, per C.D.).

## CINCHONÆ CORTEX.

The cultivation of the Cinchonas is carried on in India, in the Nilgiri Hills in the south, and near Darjeeling in the north-east, also in Ceylon, Java, and Jamaica.

The species *C. succirubra* has proved to be the hardiest and most easily propagated, and although on analysis the yield of cinchonidine and quinidine generally preponderates over that of quinine, yet the total yield—often up to 10%—of alkaloids from the bark of this Cinchona is very large (especially in the hybrids with *C. officinalis*); latterly the proportion of quinine in it has increased.

By far the largest proportion of the barks worked for quinine is Java *Ledgeriana* bark, all derived from the packet of seed obtained from one great tree by the Indian Manuel, and brought over by Ledger, which cost the Dutch Government £50 and Manuel his life. Of this bark Java produces nine to ten millions of pounds per annum, average test over 6% of sulphate of quinine, exceptional samples testing 10 to 12%. Much smaller quantities of *Calisaya* from South America, *Officinalis* from India and Ceylon, and *Succirubra* from India, Ceylon and Java, are also used, the latter being sought after by manufacturers of Pharmacopœia Germanica II. Quinine, which allows 10% or thereabout of Cinchonidine. Java Bark is year by year increasing in alkaloid content.—(Howard).

*Note* on a spurious reaction for cellulose and Cinchona Bark—a correction of Batka's test.—P.J. i./12,30.

## Extractum Cinchonæ Liquidum. (*Off.*)

Cinchona does not extract so readily with acetic acid as with alcohol and glycerin, but it gives a more permanent extract.— P.J. ii./09,142.

Methods of assay.—P.J. i./03,268; Y.B.P., 1902, 55,56. Useful suggestion for the U.S. method, Am. Jl. Ph. 1906,454. Use of alcoholic potash solution in place of aqueous.—P.J. ii./01,90; P.J. ii./05,124. Various methods of making Liquid Extracts of Cinchona discussed: that of Wobbe having advantage of small quantity of liquor and rapid percolation; the extract does not deposit.—P.J. i./04,324.

## CINNAMOMI OLEUM.

Oleum Cinnamomi (*P. Off.* C. R. 1911).—Sp. Gr., 1 to 1.030 (*Off.* 1.025 to 1.035); O. R., from — 0.5° to—1°; R.I., 1.565 to 1.580; Sol. 1 vol. in 3 to 4 of 70% alcohol. One drop dissolved in 5 Cc. of 90% alcohol and one drop of test-solution of ferric chloride added should afford a pale -green, but not a blue or brown coloration (absence of cinnamon-leaf and cassia oils). It should contain 55 to 65%of cinnamic aldehyde as determined by the following test:—Ten Cc. of the oil is added to 70 Cc. of 20% solution of sodium sulphite, and a few drops of phenolphthalein test-solution added to give a well-marked pink coloration. The mixture is heated in a water-bath, well shaken, and neutralised from time to time by the addition of a 10% solution of acetic acid until the liquid develops no further pink coloration, the process occupying from 30 to 45 minutes. The oily layer, which separates on standing, on cooling to 15°C.,should measure not more than 4.5 Cc. nor less than 3.5 Cc.,showing the presence of 55 to 65% of cinnamic aldehyde. Brewis said the increase from 55 to 75% would exclude some of the most fragrant oils.

The Bisulphite method is more commonly used, *c.f.* other Pharmacopœias —Parry.

*See* also note on Bark oil. Recent experiments in distilling show that Sp. Gr. higher than 1.016 could not be obtained. Opinion is expressed that the characters hitherto accepted for the oil have not been based on normal distillates.—P.J.ii./10,145.

## COAL TAR DERIVATIVES.

### Acetanilidum.

**Acetanilide & Methylene Blue Tubes.** *Syn.* Tubes Témoins.

Sealed glass tubes filled with Acetanilide Powder and containing in addition in the centre a small pinch of Blue Dye. These are used to place in sterilisers to determine whether sterilisation has been adequate and has penetrated into the centre of the dressings. Acetanilide melts at 113.5° C., hence if this temperature has been reached after ten minutes (to allow time for all to melt) the contents of the tube on removal should be evenly blue throughout.—*c.f.*, B.M.J. i,/11,879.

## Methylene Blue.

### Methylene Blue as Indicator in Iodometric Titrations.

When titrating with standard iodine, the usual starch indicator may be replaced by methylene blue. Use a solution of 0.05 Gm. in Water 1,000 Cc. 1 Cc. of this is added to 50 Cc. of the solution to be titrated. The end point is the change from blue to yellowish-green. J.C.S.A. ii./10,747.

### TESTS FOR PERMEABILITY OF THE KIDNEY.

**Methylene Blue Test** for the permeability of the kidney. 1 Cc. of 1 in 20 solution is injected into the gluteus maximus and the urine is turned pale green.

Discussion on the elimination of Methylene Blue.—Chromogen usually appears in 15 minutes, the blue in 30 minutes.—L. i./07,711.

The method is sufficient to compare the work of the two kidneys. Both the Methylene Blue and Phloridzin test are trustworthy.—L. i./07,795.

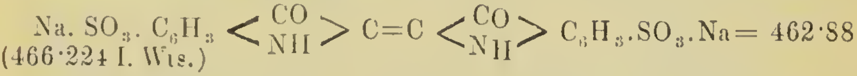
Certain organs become blue while others remain normal colour. Reduction is going on in the latter, as Methylene Blue is decolourised when reduced.—L. i. 07,784.

To determine functional condition of the stomach caoutchouc membrane capsule of $\frac{3}{4}$ grain.—L. i./08,1292.

**Indigo or Indigotin (natural)** is obtained from the shoots of *Indigofera Tinctoria* (*Leguminosæ*) in India and Java, by maceration with lime and water. The pure substance has the composition $C_{16}H_{10}N_2O_2$. For chemical synthesis, *v.*p. 174.

**Indigo Carmine** is stated to be the Sodium Salt of Disulphindigotic Acid (which acid substance is Sulphate of Indigo, or Soluble Indigo) prepared by adding gradually Powdered Indigo 1 to Nordhausen Sulphuric Acid 5 or Oil of Vitriol 8,—the vessel being kept surrounded by cold water.

**Indigo Soluble.** FR. CX. has *Syn.* Sodium INDIGO-DI-SULPHONATE, INDIGO CARMIN, CERULEINUM.



$$Na.\,SO_3.\,C_6H_3 < \begin{matrix}CO\\NH\end{matrix} > C{=}C < \begin{matrix}CO\\NH\end{matrix} > C_6H_3.SO_3.Na = 462{\cdot}88$$

(466·224 I. Wts.)

Completely *soluble* in warm but only slightly in cold water. Soluble Indigo as mostly understood is the acid substance not the sodium salt.

The Sodium Salt is formed as a precipitate on neutralising Soluble Indigo with a Sodium Salt. It has to be washed with a solution of the same salt,—to remove excess of Sulphate of Indigo. The product is pressed and dried and is then soluble in water.

**Indigo-Carmine Solution 4%.**—4 Cc. are injected into the muscles and elimination commences in 20 minutes,—the maximum is in 30 minutes later and ceases in 2 hours. Cystoscopic examination of the urethral openings and the urine gives by depth of colour indication of renal functional power.—L. i./07,793.

20 Cc. of 0·4% Solution used, *i.e.*, 0·08 Gm. injected intramuscularly,—Indigo Carmine should appear in the urine in 10 to 12 minutes if functional capacity in order.—B.M.J. i./08,89. It is suggested that the 0·08 Gm. should be dissolved in a less quantity of water.—W.H.M.

To diagnose peptic activity of the gastric juice a pill of Methylene Blue is enclosed in catgut in the form of a so-called desmoid pocket and swallowed by the patient after dinner. As soon as the catgut is dissolved Methylene Blue escapes and dyes the urine, the time required to effect that result furnishing a measure of the condition of the gastric secretion.

Methylene Blue has also been used in place of Ehrlich's diazo-reaction to indicate the presence or absence of typhoid, measles, smallpox, or phthisis; these diseases cause the urine to assume a green colour when 4 drops of 0·1% solution are added to 4 or 5 Cc. urine.—M. 1905.

**The Phloridzin Test** consists in injecting 5 mgr of phloridzin (*q.v.*) subcutaneously in 20 to 30 minims of water. Glucose should normally appear in the urine in half-an-hour.—M.A. 1904,461,462.

For determining the diseased side of the kidneys this test is frequently more delicate than the others.—L. i./07,797

For kidney examination the technique of Caspar's method which consists in the subcutaneous injection of 1 Gm. of 1% Phloridzin Solution and observation as to (*a*) excretion as sugar by a healthy kidney or (*b*) non-excretion at all or more slowly and to less extent (diseased) is described. This test as a rule exceeds the carmine blue test in delicacy, especially where pyelitis is present.—B.M.J. ii./08,998.

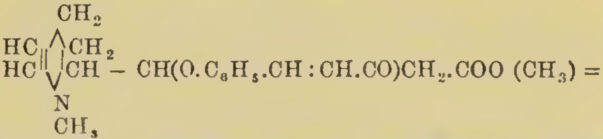
0·01 Gm. of phloridzin injected into the buttock will cause excretion of glucose 10 to 15 minutes afterwards. In extensive disease of the kidney the excretion is delayed or absent. In health it may also be delayed 30 minutes. —B.M.J.E. ii./09,22.

## COCAINA.

A Cocaine Salt in solution may be estimated by precipitating Cocaine periodide with decinormal Iodine.—P.J. i/01,553.602; ii/01,223,254.

Permanganate Test for Cocaine and Other Bodies. When a drop of a Solution of Cocaine is placed on a dried film formed by a Solution of Potassium Permanganate on a micro slide and examined under the microscope, oily drops are seen. If however, the Cocaine is dissolved in a Saturated Solution of Alum, crystals of Cocaine Permanganate will be quickly observed. Alypin, Tropacocaine and Scopolamine produce crystals from Aqueous Solutions. Beta-Eucaine, Stovaine, Novocain, Holocain and Nirvanin form no crystals with Permanganate. Saporetti's Bromine Test distinguishes these latter, for which *vide.*—P.J.i./11,94.

The four alkaloids Cocaine, Truxilline $C_{19}H_{23}NO_4$ = 326·75 (329·194 I.Wts.) (previously called Cocamine or Isatropylcocaine), Cinnamyl-cocaine



$$\mathrm{HC{\cdot}HC{\cdot}CH_2{\cdot}CH_2{\cdot}CH{\cdot}N{\cdot}CH_3} - \mathrm{CH(O.C_6H_5.CH:CH.CO)CH_2.COO\,(CH_3)} =$$

326·75 (329·194 I. Wts.), and Tropa-cocaine $C_8H_{14}NO.C_6H_5CO$ = 243·35 (245·162 I. Wts.) are known to exist in coca leaves.

Cocaine, truxilline and cinnamyl-cocaine being ecgonine derivatives yield ecgonine, acids, and methyl alcohol on hydrolysis. This fact is of importance commercially as the amorphous residue remaining after extracting as much as possible of the crystalline cocaine can be converted into ecgonine, and this by treatment with benzoic anhydride and methyl alcohol can be converted synthetically into cocaine.

Although formerly care was taken in the extraction to preserve the Cocaine now-a-days manufacturers rely on the ecgonine content. After isolation in the crude the 'Cocaine' is treated so to reintroduce the methyl and benzoyl group. Process for ecgonine estimation has been devised.—Am. Jl. Ph. Feb. '08. p. 74.

Methods of assay.—P.J. ii./03,784; C.D. ii./03,800; P.J. ii./05,724.

Cocaine volatilises at 100° C. This is of importance to recollect in analytical work.—Am. Jl. Ph., Dec. 1910, p. 576.

## CONIUM.

The ***U.S. Assay Method*** (see E.P. XIV. p. 285, for short description) is not at all satisfactory. The ammonium sulphate formed in the process does not separate completely, and the neutralization with sodium carbonate requires great care. The method given in the 1901 "B.P.C. Formulary" is more satisfactory.—C.D. ii./08,493.

**Characters and Color-Reactions of Conine, Conhydrine, Pseudoconhydrine, Coniceine,** and a new Conine isomer.

*Conhydrine* stated to have an odor resembling the urine of mice. It is crystalline—either in plates like cholesterine, or in needles.

*Pseudoconhydrine* is isomeric with Conhydrine.

*Coniceine* is optically inactive. The Hydrochloride is hydroscopic.

There is no 'dry' reaction characteristic of Conine.—P.J., ii./09,34.

Reactions of Conine alkaloids in solution.—P.J., ii /09,70, *et. seq.*

A scheme for differentiating Conine, Nicotine, Lobeline, Sparteine, the Conhydrines, $\gamma$Coniceine, and a new isomer is given.—P.J., ii,/09,103; see also —P.J. ii./05,333.

## CREOSOTUM.

Ⓟ **Creosote.** Fr. Cx. consists of about half its bulk Creosol, the other half consisting of Guaiacol with some cresylols, phlorol, or ortho-ethylphenol, etc. Easily soluble in alcohol, ether, anhydrous glycerin, chloroform, also in caustic potash and soda solutions, and in acetic acid (glacial). It distils between 200 and 220° C. U.S. (Revised) now omits glycerin test.

P.G.V.—A mixture of various Phenols and Phenolic Ethers consisting principally of Guaiacol and Creosol. Sp Gr. not below 1.080 The principal proportion distils between 200 and 220° C.

Ⓟ **Genuine Beechwood Creosote** yielded 39% Monophenols, 26·48% Guaiacol, 32·14% Creosol $C_6H_3CH_3.OCH_3.OH$ and homologues, Pinewood Creosote about the same but 20·3% Guaiacol and 37·5% Creosol and homologues—all boiling between 200 and 210°C.—Am. Jl. Ph. 1899, pp. 409-413.

Allen, Vol. II. part 2, p. 283 (1900) gives for Beechwood Creosote (200 to 210° BPt.), Phenol 5·2, 1:2 Cresol 10·4, 1:3 and 1:4, Cresol 11·6, 1:2 Ethylphenol 3·6, 1:3:4 Xylenol 2·0, 1:3:5 Xylenol 1·0, Phenols various 6·2. Guaiacol 25·0, Creosol and its homologues 35·0. He states that it is rare to find even 20% Guaiacol nowadays.

It is dextrorotatory (not *lævo* B.P.), or is inactive (Umney).

Morson's Beechwood Creosote mixes to form a clear liquid with glycerin in all proportions. Such a clear solution exposed to the air, however, becomes turbid. Creosote, unlike phenol, mixed with an equal volume of collodion does not gelatinise.

C.R.1908 suggests 'four volumes mixed with 4 volumes of 95% Glycerin forms a clear mixture which on adding 1 volume of distilled water becomes opalescent, a layer of creosote not less than the original volume separating on standing.'

## CUPRUM.

For purifying water, Kraemer found that strips of copper foil placed in water containing colon and typhoid bacilli completely destroyed same in less than four hours. Considered a safe domestic method. A piece of copper foil 3½ inches square in a quart of water six hours or so is all that is necessary.

He also gives a table of figures showing the amount of copper normally present in a number of substances in mgr. per kilo :—Belladonna contained 4,200, Henbane 3,600.—Am. Jl. Ph., June 05,274.

A sample of milk in which copper was present to the extent of 1 in 2,000,000 kept longer than usual. Experiments showed small quantities of copper salts prevent putrefaction in egg and blood albumen, meat and other nitrogenous substances. —P.J. ii./10,392.

The lobster contains 0.002% metallic copper in the whole body.—P.J i./11,405.

## EUCALYPTI OLEUM.

Ph. Ital. requires at least 70% Cineol. *E. Dumosa* plays an important part source of the Oil.—C.D., ii./09,530.

OLEUM EUCALYPTI.—(*P. Off.*) Oil distilled from the fresh leaves of *Eucalyptus Globulus*, *E. dumosa*, and other species, and rectified. Sp. Gr. as above. O.R., +10° to -10° soluble, 1 in 5 of 70% alcohol. Should contain at least 55% by vol. of cineol when tested according to the process described under "Oleum Cajuputi," (*P. Off.*). (Cineol and Terpenes.—Parry.) If 1 Cc. be mixed wth 2 Cc. of glacial acetic acid and 5 Cc. of petroleum ether, and 2 Cc. of a saturated aqueous solution of sodium nitrite added, and the mixture gently shaken, no crystalline precipitate should form in the upper layer (exclusion of oils containing much phellandrene).

The percentage of Eucalyptol should be left for decision when the therapeutic value of the substance is settled. Genuine "Globulus" Oils usually contain 55 to 65%. The very high testing Australian Oils are less desirable pharmaceutically on account of the irritating Aldehyde which produces coughing.—P.J. ii./10,437. In a paper on Antiseptic Power of Essential Oils (*c.f. Vol. I.* p. 551, *Vol. II.* p. 58), we wrote :—

'As the action of Eucalyptus Oils is generally considered due to antiseptic power, it would seem desirable not to exclude oils rich in Phellandrene.' We also recommend that the Oil must not be of such a character as to produce a choking sensation on inhalation This spasmodic effect is stated to be produced by aromadendral and other Aldehydes. Of three samples—Eucalyptol, Oil of Eucalyptus Globulus, and Oil of Eucalyptus Amygdalina—under discussion, the 'Amygdalina' produced by far the most choking, and the 'Globulus' had by far the pleasantest smell.

The "Chemist and Druggist," Dec. 3, 1910, commenting on this, said :—Amygdalina Oil was deofficialised because it was supposed that the efficacy of Eucalyptus Oil is due to Eucalyptol ; but it was pointed out in 1885 that the reputation of the Oil in Europe was based upon the use of Amygdalina Oil.

**Phellandrene,** $C_{10}H_{16}$=135·1 (135·128 I. Wts.) is a large constituent of the oil of *E. Amygdalina*. The irritating effect of some Oils when inhaled has been attributed to this body, but the more general view is that the Aldehydes produce it.—*c.f. Vol. I.* p. 551.

The resorcin method of determining eucalyptol in the oil found to be misleading. Resorcin solution gives results 25 to 50% too high. The process in the U.S.P. gives results invariably too low.—C.D., Jan. 11/08, p. 55.

Eucalyptus Oil (*Amygdalina Var.*) is used in metallurgy in treating refractory ores, which are ground with water to which a small percentage of the oil is added, the effect of the oil being to bring the mineral particles to the surface.—C.D. ii./10,50. Enormous quantities of the oil have been consumed in preparing sulphides of zinc and lead. About $\frac{1}{2}$ lb. oil is emulsified by vigorous shaking with about 100 gallons of water, and with this mixture the moistened or powdered ore is stirred. The oil absorbs the sulphide particles and carries them to the surface, together with the gold and silver contained in them, up to 95 per cent. of the actual content of the powdered ore being recovered by the process. The Barrier mines already consume about 10 tons of eucalyptus oil monthly.—Schimel & Co.'s Report, per Austr. Jl. Ph., Dec. 1911. See also C.D. ii./10,679. "Phellandrene Oils" work better than others and can thus be used up.—Na., June 1911 584 ; P.J. ii./11,30.

# FERRUM.

## Pilula Ferri (*Off.*).

A little Reduced Iron added would prevent oxidation.—P.J. ii./03,916.

*C.R.* 1911.—Mix Liquid Glucose 15 Gm. with Distilled Water 2.0 Cc. and Exsiccated Ferrous Sulphate (in powder) 15.0 Gm., add exsiccated Sodium Carbonate (in powder) 9.5 Gm., mix and set aside for 10 minutes or till reaction is complete, then add Tragacanth 1.0 Gm. and Gum Acacia 3.5 Gm., mix and form a mass.

The employment of sodium bicarbonate in place of the carbonate, together with plenty of water, a little honey and gum acacia, produces a pill which will keep unoxidised for a long time.—C.D. i./05,793 ; P.J. i./05,765.

The original formula was published in 1832 :—Dried Ferrous Sulphate and dried Potassium Carbonate equal parts with Mucilage of Tragacanth and Powdered Licorice.—P.J.ii./06,369.

Iron acts more as a stimulant to the blood-forming organs than as a constituent of new blood. In whatever way it enters the blood corpuscle iron is an essential factor in treatment.—B.M.J. ii./09,1423.

In pernicious anæmia rapid increase in number of red corpuscles under Blaud Pill capsules.—B.M.J. i./09,209.

Patients suffering from chlorosis improve more rapidly under a ferrous carbonate preparation so far as hæmoglobin content is concerned, than under Iron-protein preparations.—P.J. ii./11,16.

## Blaud Pill Estimation.

The white or other coatings having been carefully removed the weight of two pills should be carefully noted. They are dissolved in a beaker in a small quantity of water, say 15 Cc. with sulphuric acid 5 Cc. Decinormal solution of potassium bichromate (4·87 Gm. in 1,000 Cc.) is then run in until a drop of the solution no longer gives a blue colour with drops of potassium ferricyanide solution arranged on a white tile. Multiply the number of Cc. of Bichromate solution used by 0·0115 to obtain the amount of ferrous carbonate in grammes in the two pills.

Composition of 30 samples of Blaud's Pill. Some samples appear to have been made from ferrous carbonate, some contained very little sodium carbonate whilst some contained potassium carbonate.—P.J. ii./11,320.

## Ferri et Ammonii Citras Viridis.

To prepare a scale compound of ferric ammonium citrate of a green colour the proportion of acid should be raised to one molecule and a half of citric acid to one atom of ferric iron. Larger quantities of citric acid heighten the green colour, but the salt becomes more hygroscopic.—R. C. Cowley, C.D. i./11,315.

Some recent experiments by us on this matter show that the proportion of Ammonia is also of importance. Very light green scales can be produced by using only 1¼ molecules of Citric Acid to 1 atom of "ic" Iron and 1½ molecules of $NH_3$. This yields a preparation containing 22% $Fe_2O_3$.

## Syrupus Ferri Iodidi (*Off.*).

Instead of boiling the syrup to cause formation of some glucose (which has preservative action) it has been suggested to add 6 drachms of syrup of glucose to each pint of syrup in the cold.

Better to use Reduced Iron. Allcock revises formula as follows:—

Place the iron with the iodine in a bottle containing 6 ounces of the water, after reaction (about a minute) filter the solution through starch-and-chlorine-free filter paper and wash the precipitate with two quantities of 1½ ounces of water (previously well boiled and cooled). Much heat is given off. The filtrate is received into a 30-ounce bottle marked at 20 ounces, into which the powdered cane-sugar has been placed. Then well cork, put in a warm place, and shake occasionally until dissolved, and finally make up to correct volume, or the correct weight.—P.J. i./09,368.

The *addition of Hypophosphorous Acid is objected to*—it is the *instability of* Ferrous Iodide that makes it so valuable therapeutically. The absorption of the Iodine is required,—added preservative prevents or retards this. It is recommended to double the amount of iron in the U.S. preparation. Place Iron Wire 25 Gm. in a 500 Cc. flask and wash well with water, add Water 150 Cc. and then Iodine 41.5 Gm. Shake, and when the mixture is of greenish colour and free from Iodine odour boil for five minutes. Filter through a folded filter paper, the point of which dips below the requisite 700 Gm. of Syrup. When the liquid has run through wash the flask and filter with a mixture of Syrup and Water each 25 Cc., previously heated to boiling, finally make the weight 1,000 Gm.—P.J. ii./10,576.

Citric acid ¼% is even better than hypophosphorous acid as preservative.—P.J., ii./09,405.

**Ferro-Silicon.**—A physico-chemical alloy of Iron and Silicon used in the manufacture of steel goods where easy working and high tensile strength is required, in contact with water or moist air gives off poisonous gas, *i.e.*, Phosphoretted Hydrogen, Arseniuretted Hydrogen *inter alia*, hence dangerous unless correctly used. That containing between 40 to 60% Silicon contains the most impurities.—L. ii./10,220.

## GLYCYRRHIZA (*Off.*).

Glycyrrhizinum Ammoniatum, U.S.

According to some views (*c.f.* P.J. i./11,258) 'Glycyrrhizin' now applies to the sweet substance found in liquorice root by Tschirch to be a mixture of Calcium and Potassium Glycyrrhizinates and hence containing neither Ammonia or Nitrogen. This mixture is colourless when pure, the yield being about 3%.—*c.f.* Y.B.P.—1907, p. 73.

Tschirch discovered that Glycyrrhizinic Acid is the Diaglycuronic Acid ester of Glycyrrhetinic Acid. It has glucosidal properties. Glycuronic Acid, *c.f.* p.172 is of importance in animal life—an unexpected fact, as the most varied sugars are at the disposal of a plant if it wishes to form Glucosides.—P.J. ii./09, 421 ; *c.f.* also Y.B.P., 1907,73.

Examination of commercial Stick Liquorice.—P.J. i./06,491 ; C.D. i./10,21.

Analysis of Liquorice Juice. A minimum of 9% of 'Glycyrrhizin' should be present in normally prepared edible juices—they should not contain more than 18% of sugars, reducing and non-reducing. In order to determine whether the starch present (genuine juice may have starch present owing to crude method of filtration) be actual or added, the sample should be powdered, extracted with water and the residue taken up with 3% Ammonia Solution The insoluble matter should never exceed 6%. Examine this under the microscope to trace source of starch, *i.e.*, whether added or of the same character as that in the root. The amount not dissolved in 70% alcohol should not exceed 16.5%. Gum should never be present in pure Liquorice Juice.—Parry, C.D. i./11,133.

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## GUAIACI RESINA.

The PHYSIOLOGICAL ACTION OF GUAIACUM RESIN is we believe not completely understood. The drug is acknowledged to have useful effect in gout and rheumatism.

We recently conducted investigations to determine whether this Resin increases or decreases the elimination of Uric Acid from the human body. It was suggested (A. E. Garrod) that Guaiacum has a distinct effect in reducing the amount of Uric Acid excreted, *i.e.*, it was thought that the Uric Acid is eliminated in some other form, possibly Hippuric Acid.

A normal individual took Guaiacum Resin in 5 grain doses daily in the morning and the Uric Acid was estimated in the urines the same afternoon. Hippuric Acid was also estimated in specimens of the same urines by the method given by Allen, "Chemistry of Urine," p. 186. After a day's interval the Acids were estimated on several days without administration of the drug. The two series were then repeated on the same lines after an interval. Seeing that the diet of the individual could not well be controlled in weighed amounts of food as would strictly be necessary for an investigation of this kind, it was thought that to express the results in percentage Ratios of Uric Acid to excess of Solids (R.U.A.) over Water might yield more comparable results.

Joulie employs this method of indicating the constituents of Urine by Ratios *c.f.*, *Vol. I*, p. 736 Thus, taking a specimen of urine with the following 'Normal' factors in Gms. per litre.

| | | | |
|---|---|---|---|
| Specific Gravity .. | 1017.8 | Cl. .. .. .. .. | 6.86 |
| Excess of Solids over Water | 17.8 | Urea .. .. .. .. | 18.7 |
| Physiological acidity in terms | | Uric Acid .. .. .. | 0.41 |
| of $H_2SO_4$ .. .. | 0.849 | Hippuric Acid .. .. | 1.3 |
| Total $P_2O_5$ .. .. | 2.083 | | (mean |

one may express the constituents as the following percentage ratios :—

Normal.

R.A.' Ratio of Physiological Acidity to excess of Solids over Water .. .. .. .. 4.77 $\left(i.e. \frac{0.849 \times 10}{17·8}\right.$

| | |
|---|---|
| 'R.P' Ratio of total $P_2O_5$ to excess of Solids over Water .. .. .. .. .. .. | 11.17 |
| 'R.U.' Ratio of Urea to excess of Solids over Water .. .. .. .. .. .. | 100.53 |
| 'R.U.A.' Ratio of Uric Acid to excess of Solids over Water .. .. .. .. .. | 2.33 |
| 'R.H.A.' Ratio of Hippuric Acid to excess of Solids over Water .. .. .. .. | 7.3 |
| 'R.P./R A.' Ratio of Phosphoric Acid to ratio of Acidity (Joulie's factor, *c.f. Vol. I.*, p. 737) .. | 2.45 |

Ratio of Uric Acid, for example, is arrived at thus : $\frac{0{\cdot}416 \times 100}{17.8} = 2.33$

The results which we obtained are given in the the following table :—

Effects of Guaiacum Resin on the Urine of a Normal Individual.

| | Date. | Sp.Gr. | Urea % | Uric Acid. | Hippuric Acid. | 'R. U.A.' | 'R. H.A. |
|---|---|---|---|---|---|---|---|
| With Guaiacum. | 28/12/11 | 1.0207 | 2.29 | 0.09 | 0.09 | 4.43 | 4.34 |
| ,, ,, | 29 12/11 | 1.0247 | 1.29 | 0.08 | 0.1 | 3.34 | 4:04 |
| ,, ,, | 1/1/12 | 1.0215 | 2.56 | 0.105 | 0.15 | 4.88 | 6.97 |
| ,, ,, | 2/1/12 | 1.0241 | 2.82 | 0.10 | 0.2 | 4.2 | 8.29 |
| Without Guaiacum | 4/1/12 | 1 0229 | 2.42 | 0.06 | 0.1 | 2.62 | 4.36 |
| ,, ,, | 5/1/12 | 1.0249 | 2.42 | 0.08 | 0.2 | 3.16 | 8.03 |
| ,, ,, | 8/1/12 | 1.0255 | 3.09 | 0.10 | 0.225 | 4.11 | 8.82 |
| With Guaiacum | 11/1/12 | 1.0233 | 2.56 | 0.09 | 0.1 | 3.7 | 4.29 |
| ,, ,, | 12/1/12 | 1.0213 | 1.88 | 0.075 | 0.1 | 3.05 | 4.69 |
| Without Guaiacum | 24 1/12 | 1·0239 | 2.42 | 0.08 | 0.038 | 3.45 | 1.57 |
| ,, ,, | 25/1/12 | 1.0229 | 2.15 | 0.06 | 0·05 | 2.61 | 2·18 |

Average Uric Acid Ratio under Guaiacum Resin .. =3.39
,, ,, ,, without ,, ,, .. =3·19
,, Hippuric Acid Ratio under Guaiacum Resin =5·43
,, ,, ,, ,, without ,, ,, =4·99

The quantity of Hippuric Acid normally found is known to vary enormously, *e g* ,between 0·02 and 0·25%. From this we deduced for purpose of this investigation a mean normal R.H.A. of 7·3. A number of other investigations were conducted on analogous lines but need not be recorded.

From the results of these experiments one notices an average increase of Uric and Hippuric Acids during the '+ Guaiacum' periods. It is not possible to draw a conclusion without further corroboration. The amount of each Acid from day to day is seen to be erratic, and the process of estimation of Hippuric Acid is not accurate. A. E. Garrod's opinion in the matter may yet be substantiated by further work. The publication of these data, even if erroneous, may perhaps induce someone in hospital practice, with better facilities, to enquire into the matter.

## HAMAMELIDIS CORTEX.

### Liquor Hamamelidis.

A very considerable quantity of concentrated distillate injected into frogs and mammals produces no more effect than would be produced by similar amounts of distilled water. U.S.D.

U.S. employs dried bark; the fresh leaves are not officially employed there yet the B.P. directs the fresh leaves. This appears anomalous. The U.S. article in aroma and taste does not compare very favourably with Liquor Hamamelidis, *Off.* (which cannot be made in this country).

Is chiefly prepared in the states of Massachusetts, Connecticut and New York from the small twigs preferably in the fall, when the leaves are off. From a ton of twigs 50 to 80 gallons of distillate is produced, to which 5 to 10% of alcohol is added to prevent change.

## HYDRARGYRUM.

### Hydrargyri et Potassii Iodidum.

Ⓟ **Mayer's Reagent.**

Mercuric Chloride 13.546 grammes, Potassium Iodide 49.8 grammes, Distilled Water to 1 litre.

This reagent gives a precipitate with alkaloids.

Formerly methods of volumetric estimation of alkaloids by means of the above were in vogue, but the composition of the precipitates is variable.

### Unguentum Hydrargyri Nitratis (*Off.*).

Experiments by us at the end of 1909, with a view to determining the best mode of making this ointment, gave results which were summarised in our last edition.—*q.v*

**Martindale's Formula** for Citrine Ointment.—Using one-third only of the B.P. quantity of Acid and a volume of water equal to volume of Acid to dissolve the Mercury (in the cold), also employing White Vaseline in place of the lard, and the temperature 87°C. for mixing. Stir until cool and smooth. There was no effervescence. Even this reduced quantity of acid is more than theory demands for making Mercurous Nitrate (and slightly more than theory for Mercuric Nitrate), but excess of acid appears to be necessary for keeping qualities. Furthermore the water we found was also desirable. This ointment examined three months after making was of good colour, smooth, and easily rubbed into the skin.

The principle on which the official ointment is made appears to be that the Nitric acid acting upon the mercury in the cold produces Mercurous Nitrate and Nitrous Acid, an excess of Nitric Acid being present. On adding to the fat the Nitrous Acid forms elaïdin, and the heat of the fat causes oxidation of the mercurous salt with formation of more Nitrous Acid from the excess of Nitric Acid present. The excess of Nitrous Acid is driven off in the form of Oxides of Nitrogen.

Some discussion has taken place regarding the composition of this ointment. Cowley maintains that "it does not contain any Nitrate of Mercury whatsoever." His statement is to the effect that Mercuric Nitrate is entirely decomposed in the presence of fats and that the product consists of "Mercuric compounds of Elaidic Acid and Acids produced by the oxidation of the fats"—C.D., Jan. 7, 1911.

We replied (C.D. i./11,63) giving the results of experiments undertaken with a view to settling the matter. A separation process, to define the exact form of the Mercury, is by no means easy to devise owing to the various complications present. We stated that we agreed that there is certainly present a very large proportion of the Mercury in a condition soluble in Ether and in Petroleum Ether. We enquired as to how Cowley had proved his contention. Cowley, writing from Brisbane in February, 1911, could not give details, but asked for results of further investigation by us. We have since conducted a number of further experiments on the subject. Without describing same in detail we may say that our methods consisted (1) in finding the limit of solubility of Mercuric Nitrate in Petroleum Ether, then determining the amount of Mercury in a Petroleum Ether solution of the Ointment, using considerably less than the amount required for dissolving the $Hg(NO_3)_2$ possibly present. (2) Mixing $Hg(NO_3)_2$ in proportion assumed in the Ointment with the fatty ingredients and then estimating, using Petroleum Ether as above. We are inclined to agree from this work that the Mercury is, in the main, not in the form of Mercuric Nitrate, but on the contrary at least 50% of it is in the condition of salt of fatty acids or their oxidation products, and that practically all the Nitric Acid is decomposed or dissipated by the process of manufacture.

## HYDROGENII PEROXIDI LIQUOR.

In the official process of estimation, saturated magnesium sulphate solution i better than sodium chloride solution.

Iodometric Determination.—Y.B.P. 1911,71.

P.G V. gives method of estimating by titrating Iodine liberated from Potassium Iodide. *C.R.*, 1911 gives also new assay process.

**Rapid Method of Estimating**:—Titrate 2 Cc. in presence of a little dilute Sulphuric Acid with a solution of Potassium Permanganate 5·62 Gm. per litre until decolourised. Each volume of this solution is equivalent to an equal volume of Oxygen. 1 Cc. of 10 volume $H_2O_2$ decolourises 10 Cc. of the Permanganate, and 1 Cc. of 20 volume will decolourise 20 Cc. of it.—C.D. i./06,211. We may append explanation:—2 $KMnO_4$ =5 atoms oxygen ∴ 313·74 Gm.=55·8 litres Oxygen, *i.e.*, 5·62 Gm. =0·999 litres Oxygen, ∴ 1 Cc. of the Permanganate Solution of this strength = 1 Cc. of Oxygen.

Assay of Peroxide and amount of Acidity.—M. 1908; P.J. ii./08,460.

### *Preservatives.*

Benzoic Acid 0·05% added to Hydrogen Peroxide Solution is said to be a good preservative.

A little phosphoric acid is sometimes added as preservative. Acetanilide has also been employed and is said to be useful. It is first converted into anilin acetate and then oxidised to nitro-benzol which is recognised by the odour developed.

In the U.S.P. method of determination of free acid in Hydrogen Peroxide Solutions the presence of acetanilide appears to act the part of a free acid and to seriously interfere with securing accurate results. Direct titration in the cold gives sufficiently accurate results.—Am. Jl. Ph., Dec. 1910, p. 577; *v.* also *ibid.* Nov. 11, p. 519.

## HYOSCINA.

CRIPPEN POISONING CASE.

Hawley Harvey Crippen was convicted on October 22nd, 1910, of having poisoned his wife with Hyoscine Hydrobromide. He had purchased 5 grains of this salt. Dr. W. H. Willcox found altogether [illegible] grain of Hyoscine, equivalent to $\frac{2}{5}$ grain of Hyoscine Hydrobromide and he expressed the opinion that there must have been more than $\frac{1}{2}$ grain in the body as a whole though far more than that had probably been used. The sales were made as retail sales and recorded in the Poisons Book kept for the purpose. ‘ *The fact that a purchaser was a medical practitioner, whether registered or not, does not necessarily convert the sale of a poison by a retailer into a wholesale transaction* ’ (*Retailers should err on the safe side in the sale of Part* 1 *Poisons*).—(*C. and D.*).

It has been suggested that the Alkaloid Hyoscine might not have been found by the analyst without a hint as to its presence.

The victim had been operated on for removal of the ovaries,—this left a scar which was identified. There was some uncertainty as to how the Hyoscine was administered—Crippen stating that he made it into Tablets for his patients by impregnating ready-made Sugar discs with the medicament. There appeared to be the general assumption in the case that Hyoscine is little used except in mania—this is, of course, very far from the facts, *vide* ‘ Uses ’ *Vol. I.* p. 440.

It is the only drug described as useful in certain forms of erethismic urethritis—in doses of $\frac{1}{200}$ grain twice daily. White and Martin's “ Genito-Urinary Surgery, per J. C. McWalter (C.D. ii./10,63).

The mydriatic alkaloid found could have been one of three,—either Atropine, Hyoscine or Hyoscyamine. The alkaloid from all the organs under examination gave definite purple violet colour by Vitali's Test (*q.v.*)—turning to a brownish colour. The base was found to be gummy not crystalline. On treating a solution with Bromine in Hydrobromic Acid brown spheres were obtained. Hyoscyamine and Atropine give crystals with this test.

The distribution of the alkaloid and the fact that the best preserved organs gave the most yield excluded the possibility of its being a ptomaine from putrefaction. The melting points of the Gold Chlorides vary,—that of Atropine is 148°, Hyoscyamine 160°, and Hyoscine 199°, but apparently insufficient for determining the melting point was obtained.

*Refs.*—L. ii./10,1299; B.M.J. ii./10,1372 (complete verbal report of medical evidence). Leader on the subject in which the crimina use of Digitalin, Aconitine, Strychnine, Morphine and Atropine is dwelt upon, as also the current uses of Hyoscine.—B.M.J ii./10,1451

It is remarkable that the Alkaloid should have remained unaltered so long and in such conditions,—as the material had undergone considerable decomposition. Strychnine is well known to withstand exposure of all sorts, but it is perhaps unique in this respect; possibly Hyoscine is equally stable, but it remains to be proved so. The question is put as to whether controls had been conducted.—P.J. ii/10,511.

We were recently inquisitive enough to conduct a control experiment of this kind.

On 1st December, 1911, ½ grain Hyoscine Hydrobromide was dissolved in 1 ounce of Water and mixed with 2 lbs. Minced Cats' Meat in addition 2lbs. of the meat were operated upon without addition of Hyoscine, as control. This was left exposed two months; it was then in an advanced state of decomposition,—strongly alkaline, of pasty consistence and having a putrid odour, the weight in each case had decreased by about 45%. The two specimens were extracted with Methylated Spirit, acidified with Acetic Acid (effervescence), the liquids evaporated at about 40°C. to small bulk and extracted with Chloroform. These extractives tested with Alkaloidal Reagents gave the following :—

**Mayer's Reagent** and **Dragendorff's Reagent** gave precipitates with both extractives.

The extractive from the Hyoscine-treated meat gave precipitates with **Gold Chloride** and **Picric Acid** but the *Control did not.*

Finally the extractive from the Hyoscine-treated-meat gave definite **Vitali's Reaction** which was *not obtainable* in the case of the control. Our result is exceedingly interesting as showing that the Alkaloid Hyoscine remains intact and capable of isolation and recognition whilst in contact with a large amount of animal material undergoing putrefaction for a lengthy period of time.

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## IODUM.

In estimating Iodine in organic Iodine Compounds, *e.g*, in Jothion, it is good plan to saponify with KOH 2 Gm. Water 12 Cc. and Alcohol 30 Cc. After cooling place in separator and make acid with $H_2SO_4$; add Chloroform and then a few drops of $NaNO_2$ Solution. Shake and withdraw the Chloroform and then add a little more $NaNO_3$ and more Chloroform, and so on until all Iodine is removed. Wash with water, add $NaHCO_3$ and titrate with N/10 $Na_2S_2O_3$.—P.J. ii./11,711, *c.f.* Thyroid Gland, Martindale's estimation process.

**Limit of Violet Color produced by Iodine in Carbon Disulphide and in Chloroform :—**

In Carbon Disulphide and Chloroform we found decided mauve color is visible in 1 in 500,000 solution. In Ether the brown colour is visible in the same dilution.

## ESTIMATION OF THE 'IODINE NUMBER' OF A FAT OR OIL.

The Iodine Number indicates the percentage of iodine capable of absorption. Hübl's Iodine Solution is prepared: Dissolve Iodine 25 Gm. in Absolute Alcohol 500 Cc.; dissolve Mercuric Chloride 30 Gm. in a further 500 Cc. of Absolute Alcohol, filter and add to the first solution. Allow to stand 12 hours or so, and ascertain the strength of iodine by a standard sodium thiosulphate solution in the customary manner.

0·8 Gm. of the fat, or 0·3 Gm. of a drying oil, or 0·4 Gm. of a non-drying oil, is accurately weighed out and dissolved in 10 Cc. of chloroform. To the solution in a stoppered vessel 20 Cc. of the Hübl's Solution are added, and if the mixture becomes decolourised on standing a short time a further 10 Cc. of Hübl's Solution are added. Then add 10 to 15 Cc. of Solution of Potassium Iodide B.P. and dilute the whole with 150 Cc. of water. Determine the free iodine with thiosulphate and starch, shaking thoroughly. Conduct a blank experiment with the same quantities of chloroform, iodine, &c., deduct the quantity required in the original experiment from the volume of the thiosulphate solution used in this blank experiment and calculate into the equivalent of iodine—this again is to be calculated into units per cent. of the oil.

Example.—0·8 Gm. of a fat required 36-7 Cc. of Thiosulphate Solution = 29 Cc = 0·3651 Gm. Iodine, therefore 100 of the fat combines with $\frac{0{\cdot}3651 \times 100}{0{\cdot}8}$ Iodine = 45·6 the Iodine Number of the fat.

IODINE NUMBERS (*Allen and others*).

Almond Oil 97.5—98.9
Apricot-kernel Oil 99—102
Cacao-butter 34.0
Castor Oil 84.0—84.7
Coco Nut Oil 8 (but see also *Vol. I*, p. 80
Cod-liver Oil 140—150 (4 hours)
Cottonseed Oil 105—108
Human Fat 61.5.—L. ii./07,691.
Japan Wax 4.2
Lard 59.0
Linseed (boiled) Oil 148
Linseed (raw) Oil 156—160
Neatsfoot Oil 66.0
Olive Oil 81.6—84.5
Sesame Oil 105—108
Sperm Oil 84.3
Stearic Acid 21.7 (*c.f. Vol. I*, p. 80)

Fats dissolve more than 5 times as much nitrogen as an equal volume of water or blood plasma. Caisson disease depends on this.—L. ii./,07,691.

Comparative examination of the Halogen absorption of oils by Hübl's and other methods; the bromine method of McIlheney is better than the iodine ones —P.J. ii./09,146,201.

Halogen Compounds of fatty acids formed by Hübl's Reagent —P.J. ii./11,437.

## JALAPÆ RESINA.

Power made various Extractives of Jalap Resin—with petroleum, ether, chloroform, ethyl acetate, and alcohol—all of these excepting the first produced purgation of dogs. He concludes that none of the amorphous bodies obtained from Jalap should have chemical formulæ assigned to them. —P.J. ii./09,7.

U.S. requires at least 7% total Resin, of which not more than 15% should be soluble in Ether.

Small samples of the tubers taken for assay to indicate bulk are most misleading.—Southall's Lab. Rep., 1912.

*C.R.* 1911.—Proposes that Scammony Resin, *q.v.* may be obtained from Orizaba Jalap Root.

The ether test for scammony was devised to detect the adulteration with jalap. Scammony resin of commerce is obtained from the roots and not from the gum resin. American Scammony called '*Orizaba Jalap Root*' (*Ipomœa orizabensis*) is used as the source of the resin.—P.J i i./05,583.

A sample of this yielded 16 to 20% resin, tested by the Official Process.—C.D. i./08,453.

Further examination of this Mexican Scammony Resin.—P.J. ii./08,366,407.

The so-called Mexican is not equivalent to the product of Levant.—L. i./09,52.

Cowie's scheme for valuation of Jalap Resin.—P.J. ii./08,363,405

Percentage of Resin in Jalap Root discussed. Is the percentage (9–11%) of resin required by the B.P. to be taken in the drug as imported or to be calculated on the powder produced by drying the Jalap only to such point that it will powder, or is it to be based upon the drug absolutely dried and powdered until no weight is lost at 100° C.? In powdering Jalap as imported the loss by moisture is 5¾%, or may be 13 or 14% drying to constant weight—views differ.—P.J. i./11,699,730. The point will doubtless be cleared up in a new Edition of the B.P. Personally we should incline to the view that that the percentage should be taken on the air-dry powder,—as used in medicine.

## MAGNESIUM.

**Magnesia Mixture** for analytical work.

Solution of Magnesium Ammonio-Sulphate (*Off.*). Dissolve Magnesium Sulphate 20, Ammonium Chloride 40, in Water 160, add Ammonia Solution 84. Allow to deposit in stoppered bottle before use. Is employed for the gravimetric estimation of phosphates. Ammonium Magnesium Phosphate is precipitated and converted by incinerating into Magnesium Pyrophosphate $Mg_2P_2O_7$ = 221·12 (222·64 I.Wts.).

## MALTUM.

**Extractum Malti. Estimation of Diastasic Power.**

Caspari recommends the titration of the resulting Dextrose with Fehling's Solution, 1 Cc. of this = 0.005 Gm. Dextrose = 0.0045 Gm. of Starch converted thereinto.

A properly prepared Malt Extract contains Maltose as its principal ingredient. Glucose and Dextrin are sometimes added as sophistications, and the Protein content is consequently lowered—the latter should be about 6% of the whole, or 8% of the total solids.

The Malt Extracts of commerce are reported on (B.M.J. ii./09,1477) the total reducing sugar found being calculated as Maltose; the Protein was arrived at from the total nitrogen found. The **Diastasic Power** was ascertained by a modification of the B.P.C. method (*vide* above) and was expressed as the percentage of Starch which was digested by the Extract in half an hour at 40° C., *i.e.*, a Diastasic Power of 500 means an extract digesting five times its weight of starch. The percentage of Maltose in the same varied from 53·6 to 75·2, and the Diastasic values from 9 to 413.

For the results of the analyses, *vide* B.M.J. ii./09,1477; i./10,30.

Some of the preparations are referred to in our Patent Medicine Chapter.

HARRISON'S method of determining diastatic value of Malt Extract: Glycerin is a frequent addition and might be approved of for an Official preparation to extent of 5% by volume. Proteids might be 5% at least. A lower figure for Proteid would point to added Glucose or other non-nitrogenous matter. Added Glucose to be entirely excluded and test for it provided. After reviewing the various methods, and the pros and cons of the amount of Maltose produced methods as against the time-taken-to-convert-a-given-weight method, the former is decided upon, employing Anhydrous Potato Starch 1 Gm. in Water 100 Cc. with 0.2 Gm. Malt Extract. After half an hour at 40° C. the Maltose formed is titrated. If the Diastasic Power is over 500 repeat the test using less Malt Extract.—P.J. i./09,390; ii./09,148.

Harrison supports his method in several lengthy contributions. P.J. ii./10 121,290,330; in answer to Ling—*ibid.*, p. 267,312.

Description of KJELDAHL'S research on the measurement of diastasic power. The action of diastase he showed was influenced by amount of the malt extract present, the temperature of the experiment, the length of time of digestion and the concentration of the solution.—A. R. Smith, P.J, ii./10,362,

'Diastasic' to indicate the nitrogenous principle, produce during germination of Barley, capable of disintegrating the Starch Molecule, is more correct than 'diastatic.'—C. H. Fielding, P.J. ii /10,312,333.

***Adulterants.***—The principal adulterants found were materials containing dextrose, *e.g.*, starch, syrup and molasses-syrup (from beet sugar). The dextrin formed in mashing of Malt is never much less than 10% of the Maltose formed. The amount of dry solids is determined, the amount of sugar reckoned as Maltose, and the proportion of Nitrogenous substances. If the two latter are added together and deducted from the total dry solids, the result is the amount of non-reducing Nitrogen free Extract, which is practically speaking dextrin, and the figure is called the dextrin figure, usually 9 to 14. If below the minimum one can conclude adulteration with glucose or starch syrup, because the dextrose of these has a much greater reducing power than Maltose. Maltose produces less acidity, *i.e.*, less irritation to the bowels. 70% of Maltose is absorbed in the first hour, whilst only 20—40% of other Sugars. Addition of glucose reduces protein content and the organic phosphorus. The food value of Malt Extract depends directly on its diastasic strength.—Max Hamburg.—P.J. ii./09,123.

### Experiments to Determine the Incompatibility of various Chemicals with the Diastasic Power of Malt Extract.

Preliminary control experiments showed the diastasic power of Malt Extracts of commerce to vary considerably. It is well known that the B.P.C., 1901 method of testing is inclined to be too stringent. A modification of the process consists in the requirement that under the conditions specified 0.5 Gm. of Malt Extract *shall convert its own weight of arrowroot in 20 minutes* (*Umney*). *This we have found to work satisfactorily.*

Experiments were conducted on lines somewhat analogous with those carried out in the case of Pepsin and Pancreatic Ferments (*q.v.*) Average doses (with some exceptions) of a selected list of the chemicals concerning which the information would prove of value, were mixed with 24 ounces of an Arrowroot Mucilage 1% strength and then 1 ounce of a 20% malt extract added and the mixtures kept at 100 F. for 30 minutes and examined at 15 and 30 minutes respectively for unconverted starch.

In the following list + indicates complete conversion of the starch—*i.e. such chemicals are compatible with the Diastase of Malt* under conditions approximating those occurring *in vivo*.—Indicates Incompatibility.

### Effect of Certain Chemicals on Malt Diastase.

(+ Indicates Compatible.)

| CHEMICAL. | AMOUNT USED. | EFFECT AFTER 15 MINUTES | EFFECT AFTER 30 MINUTES |
|---|---|---|---|
| Acetonum .. .. .. .. | 90 minims | + | + |
| Acid Aceto-Salicylicum .. .. | 10 grains | — | partial |
| ,, Benzoicum .. .. .. | 10 grains | + | + |
| ,, Boricum .. .. .. .. | 10 grains | + | + |
| ,, Carbolicum .. .. .. | 3 minims | + | + |
| ,, Coumaricum .. .. .. | 10 grains | + | + |
| ,, Gallicum .. .. .. .. | 10 grains | partial | + |
| ,, Hydriodicum .. .. .. | 10 minims | partial | + (only just so) |
| ,, Hydrobromicum .. .. | 30 minims | — | — |
| ,, Hydrochloricum .. .. | 10 minims | — | + |

| CHEMICAL | AMOUNT USED. | EFFECT AFTER 15 MINUTES. | EFFECT AFTER 30 MINUTES |
|---|---|---|---|
| Acid Hypophosphorosum | 8 minims | — | — |
| ,, Phosphoricum Dil | 10 minims | partial | + |
| ,, Sulphurosum | 30 minims | — | — |
| ,, Salicylicum | 10 grains | — | — |
| ,, Tannicum | 10 grains | — | — |
| Ammonii Carbonas | 7 grains | + | + |
| Caffeinæ Citras | 5 grains | partial | just + |
| Caffeinæ Sodio-Salicylas | 5 grains | + | + |
| Calcii Glycerophosphas | 5 grains | + | + |
| Calcii Hypophosphis | 5 grains | + | + |
| Chloral Hydras | 10 grains | + | + |
| Chloroformum | 10 minims | + | + |
| Creosotum | 3 minims | + | + |
| Cupri Sulphas | 1 grain | — | + |
| Fel Bovis | 10 grains | + | + |
| Ferri et Ammonii Citras | 7 grains | + | + |
| ,, Perchloridi (Liquor) | 10 minims | — | + |
| ,, Sulphas | 3 grains | + | + |
| Formalin | 1 minim | + | + |
| Glucose | ½ ounce | + | + |
| Glycerinum Pancreatis | 60 minims | + | + |
| ,, Papain | 30 minims | + | + |
| ,, Pepsin | 60 minims | + | + |
| ,, Trypsin | 60 minims | + | + |
| Glycerinum | 120 minims | + | + |
| Guaiacol | 3 minims | + | + |
| Hydrargyri Perchloridum | 1/24 grain | + | + |
| Hydrargyri Iodidum (with Potassium Iodide) | 1/24 grain | + | + |
| Hexamethylenetetramine | 10 grains | + | + |
| Hydrogenii Peroxidum 10 vols. | 60 minims | + | + |
| Liquor Donovani | 10 minims | + | + |
| Lithii Citras | 7 grains | + | + |
| Magnesii Sulphas | 60 grains | + | + |
| Manganesii Hypophosphis | 7 grains | + | + |
| Paraldehydum | 30 minims | + | + |
| Piperazin | 10 grains | — | — |
| Potassa Sulphurata | 5 grains | — | + |
| Potassii Bicarbonas | 20 grains | + | + |
| ,, Bromidum | 20 grains | + | + |
| ,, Chloras | 10 grains | + | + |
| ,, Hypophosphis | 4 grains | + | + |
| ,, Permanganas | 2 grains | — | — |
| ,, Tartras Acidus | 30 grains | partial | + |
| ,, ,, Neutrale | 60 grains | + | + |
| , Iodidum | 10 grains | + | + |
| Phenazonum | 10 grains | + | + |
| Pyramidon (note this alone gives a Violet with Iodine) | 5 grains | + | + |
| Phosphorus | 1/50 grains | + | + |
| Quininæ Hydrochlor. | 5 grains | + | + |
| , Bi- ,, | 5 grains | + | + |
| Sodii Nitris | 1 grain | + | + |
| Syrupus Eastoni | 30 minims | + | + |
| ,, Ferri Iodidi | 30 minims | + | + |
| , Phosphatis | 30 minims | + | + |
| Terpinol | 3 minims | + | + |
| Thymol | 1½ grains | + | + |
| Tylmarin | 10 grains | + | + |
| Zinci Bromidum | 2 grains | + | + |
| ,, Sulphas | 2 grains | + | + |

The following gave—in *stronger proportion*, viz., average dose in *only* 5 *ounces* of the fluid the effects indicated ;—

| CHEMICAL. | AMOUNT USED | EFFECT AT 30 MINUTES. |
|---|---|---|
| Acid Aceto-Salicylicum .. .. .. .. | 10 grains | — |
| ,, Benzoicum .. .. .. .. .. | 10 grains | — |
| ,, Gallicum .. .. .. .. .. | 10 grains | — |
| ,, Hydriodicum .. .. .. .. .. | 10 minims | — |
| ,, Hydrochloricum .. .. .. .. | 10 minims | — |
| ,, Phosphoric Dil .. .. .. .. | 10 minims | — |
| Caffeinæ Citras .. .. .. .. .. | 5 grains | — |
| Glycerinum Pepsini .. .. .. .. .. | 60 minims | — |
| Cupri Sulphas .. .. .. .. .. | 1 grain | — |
| Ferri Perchloridi Liquor .. .. .. .. | 10 minims | — |
| Potassa Sulphurata .. .. .. .. .. | 5 grains | — |
| Potassii Tartras Acidus .. .. .. .. | 30 grains | — |
| Syrupus Eastoni .. .. .. .. .. | 30 minims | — |
| Zinci Bromidum .. .. .. .. .. | 2 grains | partial |
| ,, Sulphas .. .. .. .. .. | 2 grains | — |

It will be seen therefore that the following in general are *incompatible* with Malt Diastase.

Acids,—various, Inorganic and Organic, and Acid preparations :—
Ferri Perchloridum,
Pepsin preparations,
Piperazin,
Potassii Permanganas.

And that a very large number of substances which might have been expected to have decided inhibitary action on the ferment are apparently *compatible* and may hence be prescribed simultaneously when required. *c.f.* also Enzyme Action, *Vol. I.* p. 600.

Free Ammonia (not included in our list) is stated to inhibit Malt Diastase.

# NITROGLYCERINUM.

## *Assay of Nitroglycerin in Solutions and Tablets.*

Pure fused Potassium Nitrate 0·722 Gm. is dissolved in Distilled Water, *q.s.* to 1,000 Cc. and used as standard. One Cc. of this solution contains 0.0001 Gm. Nitrogen in form of Nitrate—thus 1.2 Cc. will contain the same amount of Nitrogen as $\frac{1}{100}$ grain of pure Nitroglycerin. If an Alcoholic Solution be the subject of analysis the equivalent of 0.00065 Gm. ($\frac{1}{100}$ grain) of pure Nitroglycerin (calculated) is measured out and allowed to evaporate spontaneously in a dish and in another dish 1.2 Cc. of the standard is measured and evaporated at a low heat. When both are dry 2 Cc. of Phenol-disulphonic Acid Reagent are added to each—both are well stirred and left 10 minutes, diluted with water, rendered slightly alkaline with KOH and diluted to 100 Cc. or less in Nessler tubes and compared. For Tablets, 5 tablets are powdered, dissolved in 10 Cc., filtered and 2 Cc. of the filtrate (or equivalent of $\frac{1}{100}$ grain) treated as above.

**Phenol Di-Sulphonic Acid Reagent.**—Heat Phenol 3 Gm. with Sulphuric Acid 37 Gm. in a flask on a water bath at or near 100° C. for 6 hours —Sutton's Volumetric Analysis.

We have found the method to give concordant results with Alcoholic Solutions of Nitroglycerin, but it is not satisfactory for the Tabellæ as made by the writer.

## NUTRIMENTA.

**Foods** may be classified as follows:—

1. **Proteids.** (*a*) free and (*b*) combined.
   (*a*) These include the Albumins and Globulins and the results of proteolysis of these, viz., Albumoses and Peptones.
   (*b*) These contain Hæmoglobin, which is an albuminous compound with a complex iron body; Glycoproteids, which are compounds of proteids with carbohydrates; Nucleoproteids, which are compounds of proteids and Nucleic Acid, which latter is an organic compound of Phosphoric Acid.
   The decomposition of proteids produces the nitrogenous extractives, *i.e.*, Urea, Purin or Alloxuric bodies, such as Xanthin, Hypoxanthin and Uric acid, Creatin and Creatinin.
2. **Fats.** This group of proximate principles of the tissues, is represented by the glycerides, triolein, tripalmitin and tristearin (*v.*p. 75). Here is to be included also Lecithin, which on hydrolysis yields glycerophosphoric acid and Choline—the latter is an alkaloid allied to Neurine, and when in excess is a sign of nervous tissue degenerating and will produce toxic symptoms when existing in quantity in excess of the amount which can be oxidised into urea.
3. **Carbohydrates.** These may be in part decomposition products of the proteids and in part material about to be dealt with by the bioplasm, they are Monosaccharides, $C_6H_{12}O_6$ (Glucose, Galactose and Mannose), Disaccharides $C_{12}H_{22}O_{11}$ (Cane Sugar, Milk Sugar, and Maltose), Polysaccharides $(C_6H_{10}O_5)_n$ (Glycogen, Starch, and Cellulose).* They are all converted into glucose in the body, whilst they are also stored up as glycogen or animal starch pending metabolism in the liver, muscles, &c.—"Nutrition and Malnutrition"—Allchin, L. i/05,1111.

**Biuret Reaction.**

This reaction is used as one of several general reactions for albuminoid substances. *Vide* Schmidt, Vol. II., 2. 1777.

It is used in particular to recognise Urea, which heated in a capillary tube, until the melted Urea is distinctly turbid, and dissolved on cooling in water with a few drops of Soda Solution added, gives, on adding a drop of dilute Copper Sulphate Solution, a red to violet colour, which turns to blue on further addition of the Copper Solution.

To obtain good results with this test in the recognition of Protein, the test solutions of Albumin, Copper Sulphate and Sodium Hydrate are best of following strengths:—Albumin in Distilled water 0·2%, Sodium Hydrate 1 Gm. in 10 Cc., and Copper Sulphate 5 Gm. to 100 Cc. water. Limits of delicacy both with this and cold Nitric Acid are given.—Bio. Chem. Jl., Vol. IV.; L. ii./09,302.

**Proteins,** Nomenclature of. Desirability for revision. I. 'Proteid' should be rejected. II. 'Protein' is recommended. If used at all the word 'Albuminoid, to be viewed as a synonym of Protein. III. The sub-classes to be protamines, histones, albumins, globulins, sclero-proteins, phospho-proteins, conjugated proteins, derivatives of proteins, polypeptides. IV. The term 'Caseinogen' to be used for the principal protein in milk and Casein for its derivative,—the result of action of rennet. V. The two principal proteins of the muscle plasma to be called paramyosinogen and myosinogen,—soluble myosin to take the place of v.

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*Note.—Importance of removing Carbohydrate matter from the teeth. Many organisms in the mouth ferment. Carbohydrates producing chiefly Lactic Acid. MONOSACCHARIDES are the most readily fermented. DISACCHARIDES require to be first inverted to MONOSACCHARIDES by an enzyme formed by certain of the mouth organisms before Lactic Acid can be produced. STARCHES require a double inversion—the first stage brought about by ptyalin or organisms before fermentation to an acid can occur. Formulæ are given showing that 1 mol. $C_6H_{12}O_6$ (glucose) produces 2 mols. Lactic Acid; 1 mol. of the Disaccharide Cane Sugar $C_{12}H_{22}O_{11}$ + 1 mol. $H_2O$ gives 1 mol. each Dextrose and Lævulose, with ultimate formation of Lactic Acid; and that the polysaccharide $(C_6H_{10}O_5)_n$ (Starch) + $H_2O$ = $C_6H_{10}O_6$ Dextrin + $C_{12}H_{22}O_{11}$ Maltose, which Maltose is converted into 2 mols. Dextrose, and ultimately to Lactic Acid. The Lactic Acid dissolves the lime salts of the enamel and a cavity is originated at the point of action.—B.M.J. i/09, 396.

Fürth's soluble myogen fibrin. The term myosin to be restricted to the final product formed during rigor mortis.—L.i./07, 672; P.J. i./07,288.

The analysis (hydrolysis) of Proteins gives glycocoll, alanine, leucine, etc.,—amido-acids. Fischer, starting with glycocoll, has synthesised 100 bodies closely allied to peptones,—he designates them 'polypeptides'—the work gives biology a clearer insight into the chemistry of animal and plant life. He thinks the synthesis of enzymes also possible.—P.J. i./07,260; Am. Jl. Ph. April, '07,168.

AMIDO-ACIDS.—These are very important constituents of Proteins. It has been suggested that all proteins are derived from Aspartic Aldehyde by condensation. They are both basic and acidic, *e.g.*, the following:—

Carbamic Acid (Amido-formic).
Glycocoll $C_2H_5NO_2$ (Amido-Acetic Acid) and Sarkosin (Methyl-Glycocoll).
Alanine $C_3H_7NO_2$ (Amido Propionic).
Leucine $C_6H_{13}NO_2$ (Amido Caproic).
Aspartic Acid $C_4H_7NO_4$ (Amido Succinic).
Glutarminic $C_5H_9NO_4$ (Amido-Glutaric).
Tyrosine $C_9H_{11}NO_3$ Hydroxyphenyl Amido-propionic Acid.
Taurine $C_2H_7NSO_3$ Amido-ethane Sulphonic Acid.

At the moment of death proteins change in composition. Dead proteins consist of a mixture of Amido Acids.—Tibbles *q.v.* for a full account of the theory of Proteins.

The complex molecules of the Proteins have been found to be built up of a number of comparatively simple fractions which can exist independently and which, widely as they differ in structure have in common that they belong almost without exception to the above group of Amido Acids. Some of these fractions are occasional constituents of the excreta, *e.g.*, leucin, tyrosin, cystin in which last the Sulphur of Proteins resides. From others the equally familiar excretory products, or products of putrefaction are derived,—such as Indol from tryptophane, cadaverin from lysin and putrescin from arginin.—A. E. Garrod.—B.M.J. i./11,1413.

Carbohydrate Metabolism (Pavy).—L.i./05,1704; ii /05,4342.

Pathology and treatment of diabetes mellitus. Three lectures dealing principally with the physiology of diabetes. Several Diabetic Foods are shown to contain a large proportion of Carbohydrate as starch—these constitute source of great harm. As to drugs something is wanted to set metabolism right in the way that Thyroid Extract acts in myxœdema—but a strong believer in Opium and some of its derivatives.—Pavy.—L. ii /08,1499,1577 1727.

Further remarks by Halliburton on.—L. i./09,21.

## Yeast Extracts as Food.

Yeast extracts have been made and substituted for meat extracts; a test has been published for detecting this substitution.—P.J. ii./03,516,704; *vide* also Y.B.P. 1907, 101.

The test is based on the fact that Meat Extract contains both creatine and creatinine, whilst Yeast Extract contains neither. The "Lancet" (i./07 1505) believes the test to be a conclusive one if carried out satisfactorily. We have tried the test on Yeast Extract and a well-known brand of Meat Extract, and must confess we obtained brownish red colours with both—difficult to distinguish one from the other.

Liquid foods, according to recommendation in America, should contain at least 8.8% solid constituents, and should possess at least as much nutritive power as milk. One-fourth of it, exclusive of Alcohol and Glycerin, should be in the nitrogenous matter. The protein matter should be converted by pepsin or pancreatin—not by acids.—L. ii./07,308.

**Ju-vis** was condemned. Creatin + Creatinine Estimations indicated that it contained only 8% of Meat Extract. Creatin + Creatinine in genuine Meat Extracts is on average 10·85%. It was stated to contain 18% Meat Extract, 21% Yeast Extract and the rest Gelatin, flavouring and water. Yeast Extracts *in toto* are objected to.—Gamgee.—B.M.J. ii./08,449.

Bearing on this controversy the following may be noted —

"In a recent article Gamgee states that the ingestion of Yeast Extracts involves the enormous increase of Purin bases as compared with an ingestion of meat extracts. The figures he reports are, Purin base, Nitrogen of Yeast Extracts 0.646% of meat extracts 0.433%. Some recent reports by Chapman show that the Purin contents of meat and yeast extracts are practically identical and this agrees with the findings of the writer. There is no conclusive proof of Gamgee's claim that the purin bases of yeast extract are more injurious than those of meat preparations."—U.S. Dept. of Agriculture, Bureau of Chemistry, No. 62, Nov. 15, 1910. See also A. C Chapman, B.M.J. ii./08,1741.

Providing correctly (and not wrongly) labelled, **Yeast Extracts** may be quite good and wholesome in their way. They are practically identical in composition with Meat Extracts and similar in taste. Their presence in Meat Extracts can sometimes be determined microscopically by observing yeast cells. Diluted Fehling's Solution on being brought to the boil after adding a quantity of the Aqueous Solution of the extract to be examined shows a bulky curdled precipitate of greenish grey colour if yeast extract be present.—P.J. ii./11,72.

Yeast as Food.—It has been suggested to use the washed yeast of German breweries. Experiments have shown that dogs assimilate 87.2% of the Nitrogen in the yeast. The slight bitter taste of fresh yeast can be removed by treatment in the cold before drying with Sodium Carbonate.—P.J. ii./11,448.

## Hæmoglobin.

### Defibrinated Blood and Globin Solution in treatment of Cancer.—

Experiments by H. C. Ross (' Induced Cell-Reproduction and Cancer,' p. 210) show that *in vitro* cell division is " directly caused by certain constituents of the soluble remains of dead tissues." In the neighbourhood of old healing ulcers the Hæmoglobin is evidently decomposed,—as the Hæmatin produced in consequence collects as insoluble pigment. When Hæmoglobin decomposes thus into Hæmatin and Globin the former is insoluble in water, except in presence of dilute alkalis. Globin is stated to be readily soluble,—hence this substance (if either of the two) is thought responsible for causing proliferation. A saturated solution of Hæmoglobin on prolonged boiling precipitates the Hæmatin and gives a straw-coloured filtrate which, on evaporation, when reaching saturation point about 4%—becomes deep red. Globin is a protein not precipitated by boiling, decomposing on keeping and giving off a foul smell.

(NOTE.—According to Allen, Vol. IV., p. 411, Globin is coagulated by boiling. It may be kept in solution by adding alkali. In presence of alkali it is converted into the condition of alkali-albumin) Ross has employed this saturated solution at Liverpool in chronic callous ulcers of the leg (simply applied with a little sterile gauze)—granulations set in rapidly and in 20 hours marked effect was seen. Globin has also been used dried in small pieces ' dotted ' on to the ulcerous surface,—this causes extensive proliferation of the epithelium from the sides of the ulcer, but suppuration is likely to occur, even if the dried Globin is prepared with aseptic precautions. Scabs form which have to be removed with fomentations and the process repeated. A mixture of powdered Globin 5 with Kreatin 2 has also been used and produces more marked proliferation.

This Investigation, according to Ross, affords proof that the " *cell proliferation of healing can be caused by the chemical auxetics Kreatin and Globin.*"

*Prevention of Proliferation.*—Normal Blood Serum (*vide ibid* p. 253) has the power of preventing the ' natural ' auxetics from inducing cell division (Bashford & Murray showed that serum has the power of restraining the growth of secondary transplanted tumours in mice). Bashford and others also showed that transplanting living growths in mice protect same to some extent against cancer. ' It was considered possible that this (*ibid* p. 254) might be due to the fresh augmented auxetic produced by the transplanted growths giving *rise to increase in content of restraining body.*' Hence a process of treatment of cancer patients was devised by injecting them with augmented auxetic combined with Blood Serum,—6 ounces of defibrinated sheep's blood being given per rectum every morning. This serum contains the restraining body, and it was thought that the red cells would be destroyed in the rectum, the Hæmoglobin would be decomposed and in time the Globin would become augmented by the action of bacteria present. It was thought that the estraining body of the serum, the auxetic in the globin and in the remains of the white cells, and the products of decomposition would be gradually absorbed and that they might raise the content of the restraining body in the patients—in other words, act as a sort of vaccine. Several cases were treated on these lines—in some with apparent benefit.

**Solution of Globin** for rectal use has been made by boiling Hæmoglobin of commerce (*i.e.*, Oxyhæmoglobin) and removing the Hæmatin, subsequently adding a small quantity of Sodium Carbonate. This has been prepared 5% strength approx. in 'Globin.' 1 molecule of Hæmoglobin (Allen, *ibid*) is understood to yield two molecules of Globin (the molecular weight of this body being probably about half that of Hæmoglobin)—and 1 molecule of Hæmatin (the molecular weight of which is minute in comparison).

## Milk Preservation.

Experiments show that Boric Acid 1 in 2,000 and Formaldehyde 1 in 50,000 preserve milk for 24 hours. Refrigeration and pasteurisation preserve without intervention of these chemical aids.—B.M.J. i./05,1412.

Filtration by means of sand has been suggested. This is largely done on the Continent. See also article on milk preservation.—B.M.J. i./08,936.

**Ortho-Methyl Amino-Phenol-Sulphate,** or ***Ortol** (which is a mixture of this body with Quinol and is used in photography) are recommended for milk testing. One Cc. 1% solution is added to 10 Cc. of milk and followed by 1 drop of ordinary '10 volume' Hydrogen Peroxide. Raw milk, or milk that has not been heated above 75° C., gives a reddish pink colour —B.M.J i/03 664.

Tests for Ortol.—P.J. i./07,429.

## Budde Process of Preserving Milk.

Consists in adding 15 Cc. of a 3% Solution of Hydrogen Peroxide to 1 litre of Milk and warming to 51-52°C. for at least three hours. 48°C. is not sufficient and 55° is too high.—L. ii./05,209.

The **organisms found in milk** may be classed as follows :—(i.) Acid-producing (100 varieties), the principal member of which is *B. acidi lactici* ; (ii.) *B. acidi butyrici* (has very resistant spores, not killed by pasteurisation) ; (iii.) those responsible for fermentation to alcohol, as koumiss, butter milk, red milk, blue milk, &c. ; (iv.) the mould *Oidium albicans* produces thrush in infants' mouths ; (v.) *B. tuberculosis* (20 to 30% of the cows in this country are tuberculous) ; (vi.) *Streptococci* associated with contagious mammitis ; (vii.) *B. diphtheriæ* ; viii.) *B. coli communis* and *B. typhosus*.—B. & C.D. ii./05,576.

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## BREAD AND FLOUR STANDARDISATION.

### Flour Bleaching and Harmful Baking Powders.

During the spring of last year (1911) public opinion was stirred by the 'Standard Bread' agitation. In view of the fact that a Standardisation of Foods in general is *as important*, if not *more important* than the standardisation of Drugs a short account of the problem, which is indeed a very deep one, should find a place in the "Extra Pharmacopœia." The Standardisation of Drugs it is well known receives every possible consideration.

Before proceeding further we would draw attention to Dr. J.M. Hamill's Food Report No. 14, 1911, to the Local Government Board, on the nutritive value of bread made from different varieties of wheat flour. It gives a most useful résumé of the nomenclature of various milling products, *e.g.*—

'**Wholemeal**' or '**Graham Flour**' (actually whole grain flour).

"**Entire Wheat Flour**" or "**Fine Meal**"—a product obtained by removing a portion of the bran and grinding the rest of the grain. (This includes so called "Standard" Flour)

'Households.'—The commercially lower grade of flour obtained from roller mills—it is darkish in color.

'Patent Grade.'—Commercially the higher grade flour produced by roller mills. It is better color than any other grade of flour produced in the mill.

'Straight run' or 'straight grade'—intermediate in appearance and quality between households and patent grades.

Special flours, prepared from any of the above usually with the object of improving nutritive qualities.

This report should be read by those making a study of the subject.

One of us (W.H.M.) communicated a short note on the subject of so called Standard Bread to the "Chemist and Druggist" (C.D. i/11, Index Fo. 321) which forms the groundwork to this article. Abstracts from papers by a number of Authorities on Dietetics who have since from time to time written on the subject of "Standard" bread, its advantages and disadvantages have been incorporated.

The "manifesto" by some of the highest medical authorities defined "Standard" bread as *bread made from unadulterated wheat flour containing at least 80% of the whole wheat including the germ and semolina.*"

A glance at a sectional diagram of a grain of wheat *e.g.* as shewn in the above Food Report or on p. 266 in Jago's "Science and Art of Bread-making" shows the situation of the "germ" (a small portion of the entire grain) in the grain and enables one to understand the reason why it is in great measure winnowed away by the roller process of milling. The husk, or outer envelope yields the bran, and consists roughly of cellulose and salts, the endosperm yields the starch, the germ is rich in protein and fat. With regard to the above definition of "Standard Bread" the word, "Semolina" might just as well been omitted for the reason that it may refer to the most various products according to the fancy of the miller. Semolina of wheat is the hardest portion of the endosperm and is obtained in a granular form by adjusting the rollers sufficiently far apart, so as not to crush the granules. This is the semolina obtainable commercially. It is usually prepared from the hardest wheats, *i.e.*, those grown in Southern Europe. The modern roller mills convert the wheat into flour and "offal." Entire Wheat Flour is obtainable from the old fashioned mill stones, or by the roller mills. The germ differs considerably in composition from other parts of the grain. We have placed side by side (from W. Jago,—transposed from his figures into percentages) (*a*) the amounts of certain constituents of a wheat mixture, (*b*) the results of analysis of one of the semolina products—that coming from the second and third "breaks," (*c*) "Flattened Germ" from the same mixture and (*d*) an approximation of the contents of Bran:

| | Wheat. | Semolina. | Flattened Germ. | Finished Bran. |
|---|---|---|---|---|
| *Moisture* .. | 38.171 | 43,011 | 11,822 | 22.598 |
| *Soluble extract* .. | 16.403 | 13.577 | 43.940 | 17.567 |
| *Soluble proteid* .. | 4.361 | 3.191 | 15.652 | 2.259 |
| *Crude gluten (dry)* | 19.093 | 19.416 | — | — |
| *Ash* .. .. | 4.835 | 3 394 | 5.501 | 12 742 |
| *Phosphoric Acid* | 2,465 | 0.747 | 3.207 | 7.322 |
| *Fat* .. .. | 4 993 | 4.311 | 11.982 | 3.068 |
| *Cellulose* .. | 9.671 | 12.627 | 4 776 | 31 4 |

*Note* the figures for "*Soluble Extract,*" *Proteid,* "*Ash,*" *Phosphoric Acid* and *Fat* in the *Germ* in comparison with *Wheat,* also the figures for *Ash* and *Phosphoric Acid* of *Bran* compared with those in *wheat.*

With regard to the **mineral constituents in the ash of wheat and other cereals**:—Lime (Allen. vol. 1, p. 447) ranges from 1 to 10%; Magnesium Oxide gives an average of 12·11%; Silica rarely reaches 5% being usually less than 2%, $P_2O_5$ constitutes an average of 49 to 50%. Iron as $Fe_2O_3$ averages 1·1%.

We are fully aware that these figures *may* have no value and that it is possible to twist the data into meaninglessness, also that figures giving flour analyses vary with every authority (*c.f.* Atwater & Benedict, Hutchison, Tankard, etc.).

With regard to ***bread-making*** it may be mentioned that wheat and rye are the only suitable cereals—owing to the fact that they contain the protein "*glutin*" which becomes viscid on mixing with water—hence forming the dough. Glutin is developed by interaction in the presence of water of the two proteins **gliadin** and **glutinin.** We are indebted to Nature, May 4/1911 p. 313 for the following remarks.

The outer coats of the grain yield bran, fine pollards, sharps, and middlings. the germ is removed as offal, while ordinary flour is derived almost solely from the endosperm. The flour itself is divided into a larger portion. "bakers" or "households," and a smaller, very white and poor in protein, known as "patents," from which genuine Vienna bread and the best class of fancy breads and pastries are made. The semolina, derived from the central parts of hard wheat, and rich in glutin, is also lacking in white flour.

It will thus be seen that ordinary white flour and white bread made therefrom contain little or none of the bran germ, and semolina, and valuable food constituents—mineral matter and protein of the bran and semolina, and fat and protein of the germ—are lost. Wholemeal bread is therefore richer in the nutritive constituents and has more flavour, but is darker in colour than white bread, owing partly to the inclusion of the bran and partly to an interaction by which dextrin and sugar are formed which undergo darkening in the oven. Wholemeal bread is, however, apt to be irritating on account of the cellulose and silica of the outer coat, but by removal of the outer layers of the husk the irritant material may be excluded, and the valuable mineral, protein, and fatty constituents of the inner branny coat, semolina and germ, retained. Such a flour constitutes the "80 per cent. flour" employed in making the so-called "standard" bread. The term "80 per cent. flour" means that a wheat, a bushel of which weighs 64 lb., yields 80 per cent. flour. In the old method of milling, the wheat is ground between stones, the flour being separated by sifting, and in this way some of the "offal" is retained: hence the term "stone-ground."

There is doubtless some difference of opinion as to the relative values of ordinary and "standard" flour, and the bread made therefrom. The roller mills cleanse the wheat in a very efficient manner. Chemical analysis, except as regards salts, shows little difference between the two; "standard" bread may even be slightly poorer than ordinary bread in protein, owing to the greater percentage of moisture.

Leonard Hill and M. Flack (B.M.J i./11,1068) reported on rats fed for three weeks, some on standard bread and some on white bread, and for a second three weeks on white and "standard" flour. The result was astonishing. Of the rats fed on white bread and flour ten died, while only five died of those fed on "standard" bread and flour. The survivors of the latter lot increased in weight 27½ per cent. against 12 per cent. for those fed on white bread. Another lot fed on white flour *plus* an amount of wheat germ about equal to that in standard flour, gave results quite as good as for "standard" flour.

In a second note they express the opinion that the State should use all its powers to make wholemeal bread the food of the children of the poor. The whole meal is the real staff of life and no saving of trouble or liking "a nice looking loaf" should be the pretext for taking away substances essential for the growth of the children. It was found that rats can thrive and be reproductive on wholemeal and water. A diet of white flour and water is more harmful to young rats than old. Germ and bran are needed above all for growth.—B.M.J. i/11,1311.

In a third article they state "standard" flour proved better than wholemeal used in their previous work,—the reason being that the wholemeal previously used contained only a portion of the sharps and bran—their removal gave it a nutritive value higher than the true wholemeal, probably because this contains too much cellulose. **Hovis Flour** contains about 20% of germ. This is separated in the milling by being rolled flat. After screening off it is sterilised and added to white flour. Wholemeal contains about 1 to 2% of germ, 13% of sharps (the inner husk) and 15% of bran. The addition of 20% of germ increases the percentage of protein and insures the presence of the organic Phosphorous compounds essential to growth. The feeding experiments on rats show the *great importance of the germ of which white flour is robbed.*—B.M.J. ii./11,598.

W. Tibbles thinks rodents unsuitable animals for the experiments. Cellulose is a *sine qua non* of proper nutrition to them. There is no doubt whatever about the great nutritive value of the proteins in the germ, but its removal (which is done for the sake of color and keeping qualities) does not rob the bread of much protein. *The total proteins of the grain average* 12%,—*distributed thus—endosperm* 8·925, *germ* 0.538, *aleurone* 2·048, *episperm* 0·178, *cuticle* 0·362%. *The germ is, however, rich in Nitrogen i.e.* 6.44% *including* 0.8% *Amide Nitrogen* (the germ forms, of course, a very small proportion of the entire grain).

With regard to the **Phosphorus** in wheat bran,—this was first thought to be inorganic—then to be connected with the nuclein or salts of Nucleic Acid—but researches show that only 33% of the Phosphorus could be accounted for in this way and that the chief Phosphorus compound is a Magnesium-Calcium-Potassium Salt of a Phospho-organic Acid,—probably indentical with Anhydro-oxy-methylene diphosphoric Acid,—an acid which is widely distributed in the vegetable kingdom,—B.M.J. ii./11,861, 1137.

The higher animals are apparently not endowed with power of preparing their own organic phosphorus compounds from inorganic phosphorus, nor indeed, are they probably able to form such compounds of one group from those of another. These bodies are of far-reaching importance to the bioplasm.

It is probable that **over sterilisation** of preserved meats (*e.g.* temperature of 120°C.) causes deficiency of organic phosphorus.

Rickets has become so common—by comparison—with the German child that in Germany it is called the 'English Disease'—it is less common in the Highlands and in Ireland. The Highland child gets oatmeal containing 0.9% $P_2O_5$, mainly in *organic* combination. The Irish child gets probably fresh milk and butter (1% $P_2O_5$) in addition to potatoes which contain a fair amount of Phosphorus near the skins. Light and air may have a good deal to do with protecting both these from rickets. The German child gets rye bread, in this the organic phosphates are evenly diffused throughout, and even fine rye bread contains sufficient (1% $P_2O_5$) of these compounds. He does not suffer from rickets so much as the English child, whose diet is apt to consist largely of *skim milk*, *margarine* (0·03% $P_2O_5$), and *white bread* (0 2% $P_2O_5$)—all notably deficient in organic phosphates. At present we use the phosphates of the wheat and rice as food for our prize cattle.—B.M.J. i./11,1421.

A healthy man accustomed to a full mixed diet requires for maintenance of phosphorus equilibrium about 1·5 Gm. of phosphorus, or nearly 3·5 Gm. of Phosphoric Acid per diem; the organic combination seems to be the best. The calcium requirement is equivalent to about 0·7 Gm. of Calcium Oxide *per diem.*—Na. Dec. 1, 1910, p. 148.

W. Tibbles writing again says: "In addition to the Cellulose, the **Amino Acids (Asparagin, Leucin and Tyrosin)** are of importance. It is to the greater amount of these in the germ and cerealin that one may look for the different effects obtained by feeding with flours of various grades.—B.M.J. ii./11,1137.

In a further note L. Hill and M. Flack write: "*Wheat germ alone added to white flour* makes this an adequate food on which animals can live healthily. This proves that the lack of Cellulose has nothing to do with the insufficiency of white flour, and that whatever the active principle may be, it is present *no less in germ than in bran and sharps.* In fact, rats did better on white flour plus germ than on white flour plus sharps, bran, and a trace of germ.—B.M.J. ii./11,1330.

Robert Saundby communicated a paper on food and feeding which bears on the subject (B.M.J. i./11,1218.). We have made certain abstracts from this.—

The public were asked to adopt the view that 'white bread' is deficient in nitrogen and inferior to bread made from flour containing the whole of the constituents of the grain. **Wholemeal or Graham Flour.**—No objection can be made against white bread so long as this is not due to chemical bleaching. (For the subject of bleaching, *vide* later). It must contain weight for weight as good proportions of protein, carbohydrate, mineral matter and fat as the 'standard' article. An undesirable effect of the agitation was the unloading of large stocks of inferior flour (*Truth*, April 12, 1911, p. 207). The moisture in bread varies from 30 to 40%. In Columbia, U.S.A., the proportion is regulated by law to 31%, but here there is *no legal limit.* Excess of gluten produces a loaf that retains moisture. Beri Beri (*vide* also *Vol. I.* p. 833, *Vol. II.* p. **198**), seems to be associated with eating completely shelled rice. Something is removed in the 'polishings' which is of great importance, and there may be something of the same kind in the case of white flour. It has been brought forward that **Dental Caries** is attributable to the softness of white bread, but 'standard' bread is just as soft, and the natives of South Africa, India and Japan, subsist on soft starchy foods and have good teeth. Caries is more likely to be due to excessive consumption of sugar, which rose from 30 lb. per head in 1864 to 89 lbs. per head in 1910. The importance of doing away with hand labor for machine-made bread is strongly urged in the interests of hygiene and health. *The present conditions of many bakehouses which are overheated cellars filled with half-naked men from whose bodies sweat pours to mingle with the dough is not pleasant to think of.* A baker is stated to lose 200 to 340 Gm in weight while kneading a batch of bread, mainly in perspiration, part of which certainly enters into the dough.

The therapeutic value of **FASTING** is carefully considered in this paper, Disappearance of or amelioration of many chronic ailments in Rome after fast has been proved; prison diet has been shown to have similar effect. A fasting day from time to time in treating diabetes has been proved of value and so on. There is no doubt as to the high nutritive value of oatmeal and porridge.

### Increase in acidity of Bread during Mastication.

Hill and Flack conducted some experiments on this subject. They did not find any marked difference between the acidity produced on masticating white and wholemeal breads; (it has been said that decay of teeth is due to acid production from white bread). Thomas Read writes: "It would appear as if the ferments from the wheat germs in the wholemeal bread used by Leonard Hill had been injured before bread making—then both breads would form acid in the same way in mastication. If the ferments in the 'Standard' type have not been injured before baking, the conversion of starch into grape sugar takes place during bread making, and no acid is formed during mastication. If, on the other hand, the flour does not contain the ferments of the wheat germs or they have been injured no conversion of starch into grape sugar takes place during bread making, and when the bread reaches the mouth the ptyalin of the saliva converts starch into grape sugar and bacteria in the mouth convert this freshly formed sugar into lactic acid which decays the teeth."—B.M.J. i./11,1456.

W. A. Bond pointed out that ***flour of the 'Standard' type must contain more proteid, fat and ash, than fine white flour made from the corresponding wheat or mixture of wheats.*** He suggested a standardising method based on the presence of a substance of the nature of Phytin, also a minimum of proteid, etc.—L. i./11,1669.

Benjamin Moore writes "*anent the* **Phospho-protein in the subpericarpal layers of grain,**" that this is a glucoside—possibly galactosan. These glucosides are known as hemi-celluloses and are termed pentosans and galactosans according as they yield a pentose or galactose on hydrolysis. Polyneuritis established in fowls by feeding on polished rice can be combated by a daily ration of an alcoholic extract of the rice meal from the separated pericarpal layers, containing only 0.16 mgr. of Phosphorus Pentoxide and 4 mgr. of nitrogen.—B.M.J. ii./11,1137.

**Bleaching of Flour.**—

The bleaching of flour by chemical process is one of the crying evils, and, of course, unnecessary. It is safe to say that if the agitation did nothing more than rouse those in authority to the necessity of stopping bleaching, its work was rewarded.

The United States Government in 1910 took action against certain flour millers in regard to 625 sacks of flour which were alleged to be adulterated, and after trial the Government authorities proved their case and the flour was condemned. It had been bleached by the 'Alsop' process. "The essential apparatus in this process is a small chamber with two electrodes. One of these electrodes is stationary; the other is raised up and down by a suitable crank motion, so as to approach the first. These electrodes are charged with a heavy current of electricity. When the points of the electrodes touch, the current flows just for a second, and when they are pulled apart a flaming discharge takes place between the two. This discharge is of a high temperature—so much higher than the ordinary temperature of combustion that it causes the nitrogen and oxygen in the air to combine, actually to burn, one might say, and the result is **nitrogen peroxide**. While the electrodes are in operation, a current of air sweeps out the nitrogen peroxide, and a further supply of air is drawn in. After being swept along, the nitrogen peroxide is carried by a tube to a box, which is provided with a rotating apparatus. To this box, called an agitator, comes the finished flour from the mill, and is made to fall down through the nitrogen peroxide and air. During this passage the bleaching is effected."—From a bulletin on the case by the U.S. Dept. of Agriculture.

The result of this process is that the flour contains an appreciable amount of nitrites. The C.D. i./11,512 described the physiological effect of this flour as 'disastrous' in the case of many persons who eat bread made from it.

To this criticism we would add further criticism. What we say is that the Bleaching of Flour should be an *unnecessary proceeding and should not be tolerated.*

In a Local Government Board Report (Food Report No. 12, 1911) Drs. J. M. Hamill and G. W. Monier-Williams dealing with the action of **Nitrogen Peroxide** ($N_2O_4$.) (in quantities up to 300 Cc. per 1 kilo flour) indicate that the color of the bleached flour may change again, *i.e.*, become yellow or still more bleached according to circumstances. The quantity of Nitrous Acid or Nitrites formed is proportional to the $N_2O_4$ used. The $N_2O_4$ is present in the flour as **Nitric and Nitrous Acids** or **Nitrates** and **Nitrites**. In highly bleached flour (1 kilo with 300 Cc. of $N_2O_4$) an increase in the amounts of soluble Proteins and soluble Carbohydrates takes place. The amount of soluble Nitrogen is doubled (due entirely to the solubility of Gliadin in $HNO_3$ of certain strengths). About 6 to 7% of the Nitrogen introduced as $N_2O_4$—is absorbed by the fat of the flour—it undergoes change like an oxidised oil. The rate of digestion was greatly retarded if the starch had been previously treated with

$N_2O_4$. *Bleaching exercised an inhibitory effect on the salivary digestion of flour.*

In commenting on the above report the "*Lancet*" (L.i./II,1024) says—steps taken by other countries, *e.g.*, Australia, U.S.A., and Switzerland, to banish by statute the practice of bleaching should be a useful object lesson to the legislators of this country. (Though not allowed for sale in the United States ***there is nothing to prevent millers in U.S.A. from exporting bleached flour.***—L.ii./II,1045). The process cannot be viewed as free from risk to the consumer—especially in regard to the inhibitory effect on digestive processes and enzymes. Many millers are unaware of the nature and composition of the improvers they add. *The whole practice is conducted to make an inferior article attractive.*

B.M.J. i./II,881, also gives some very complete abstracts of these Reports. The commercial aspect has a humorous side as is shown by the following:—

> 'Some millers are at present only deterred from installing bleaching plants by consideration of expense. Others have had plants installed but have discontinued using them, in some cases for the reason that they were unwilling to pay the patentees for permission to use the process.' There is a possibility that the anti-bleach agitation may have been initiated by an interested miller.

## Calcium Sulphate in Baking Powder and Self-raising Flour.

Baking Powders, according to a L.G.B. Report on 'the presence of Calcium Sulphate in Baking Powder and Self-raising flour' (Food Report No. 13, 1911 by Dr. Hamill,) in use in this country are conveniently classed into two groups (1)—this being far the larger—tartaric powders in which the acidic constituent is tartaric acid, cream of tartar, or a mixture of these, and (2) the phosphate powders, the acidic constituent of which is acid calcium phosphate together with sodium bicarbonate in all cases. Ammonium carbonate is extensively used *per se* as a necessary ingredient in the baking of sponge cakes and other light bread products. Alum is not now employed, although it is capable of acting as an acidic constituent, and was formerly much used. In an addendum by C. H. Cribb, regarding the use of phosphate baking powders and the alleged utility of calcium sulphate in them, it is stated:

> When calcium sulphate is mixed with sodium bicarbonate in the presence of water, carbonic acid gas is evolved according to the following equation:
>
> $$CaSO_4 + 2NaHCO_3 = CaCO_3 + CO_2 + H_2O + Na_2SO_4.$$
>
> The evolution of gas commences immediately, but is very slow, so that at the end of ½ an hour only 59 per cent. and after one hour 79 per cent. of the theoretical quantity was found to have been liberated, and even after three hours the reaction was not complete. When acid calcium phosphate acts upon sodium bicarbonate one of the products of the reaction is hydrogen disodium phosphate thus:
>
> $$CaH_4(PO_4)_2 + 2NaHCO_3 = Na_2HPO_4 + CaHPO_4 + 2CO_2 + 2H_2O,$$
>
> and this salt in turn reacts under suitable conditions with calcium sulphate, giving rise to phosphoric acid, which in turn can liberate a fresh quantity of carbon dioxide from any carbonate which may be present. The first part of the reaction may probably be represented as follows:
>
> $$3Na_2HPO_4 + 3CaSO_4 = Ca_3(PO_4)_2 + 3Na_2SO_4 + H_3PO_4.$$
>
> In actual baking experiments with a baking-powder containing calcium sulphate, 75 *per cent. of the calcium sulphate* was recovered unchanged from the finished loaf. Other experiments would seem to indicate that the calcium

sulphate which has disappeared as such in the loaf is again re-formed by the agency of the acid in the gastric juice when the bread is eaten.

Calcium Sulphate occurs in commercial acid calcium phosphates to the extent of 2 or 3 per cent. up to 50 per cent. The proportion varies according to the method of preparing the calcium phosphate.

It is generally made from bone ash by means of phosphoric and sulphuric acid. When commercial phosphoric acid only is added to the bone ash, a product can be obtained containing as little as 2 per cent. or as much as 9 per cent. of calcium sulphate. When sulphuric acid alone is used, the product may contain as much as 50 per cent. of calcium sulphate; mixtures of these acids give values intermediate between the extremes mentioned. It is also stated that calcium sulphate is sometimes deliberately added as a diluent. In order to keep the acid phosphate and sodium bircarbonate from too intimate contact, a neutral non-hygroscopic powder, known as "filling," is added, such as corn flour or rice flour, the last-named being generally preferred. The filling commonly forms about one-half of the baking powder, but in cheaper powders this is exceeded. The following recipes are given in the report:

| | | | | |
|---|---|---|---|---|
| Calcium Acid Phosphate .. .. | 50 .. | 37 .. | 2 .. | 77 |
| Sodium Bicarbonate .. .. .. | 25 .. | 23 .. | 1 .. | 41 |
| Maize Starch, rice-flour or ground rice .. .. .. .. .. | 25 .. | 40 .. | 3 to 10 .. | 50 to 100 |

From ½ oz. to I oz. of baking powder is employed for each pound of flour, hence if the calcium acid phosphate of the first powder contained 50 per cent. of calcium sulphate, ½ ounce of the powder would contribute over 50 grains of calcium sulphate to the flour. The same remarks apply in regard to the calcium sulphate introduced with the phosphate, 70 grains per lb. being contained in the above flour if the first ingredient is 50 per cent. phosphate. The phosphate baking powders are said not to keep well and are not found in retail trade so much as among confectioners and bakers, who mix the ingredients when required, and so avoid deterioration. Self-raising flours are made according to the following formula:

| | |
|---|---|
| Calcium acid phosphate.. .. .. .. | 6 lb. |
| Sodium bicarbonate .. .. .. .. | 3 lb. |
| Flour .. .. .. .. .. .. | 280 lb. |

Dr. Hamil, (*inter alia*) makes the following recommendations:

(*a*) *Manufacturers of acid phosphates* should not prepare even their cheapest qualities of acid phosphate, for sale as food ingredient, in such a way that it contains more than 10 per cent. of calcium sulphate.

(*b*) *Bakers, self-raising flour makers*, and others using acid phosphate in the preparation of food, should limit themselves to acid phosphate of high commercial quality—calcium sulphate not to exceed 10 per cent.—L.G.B. Report and Editorial comment C.D. i/II, Index Fo. 545.

**Added Mineral Substances.**—

'Improvers' in form of Acid Potassium Phosphate, or Acid Calcium Phosphate or even Phosphoric Acid enables the miller to use a larger proportion of cheap wheats in blending, etc., and introduces more water into the bread. These improvers may be contaminated with Arsenic and in any case their addition is not in order. Flour contains its phosphorus in organic not inorganic form.—P.J. ii./11,71.

Section 3 of the Sale of Food and Drugs Act, 1875, provides that no person shall mix any article of food with any ingredient or material to render it injurious to health.—*c.f.* L. i./12,842.

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Reverting again to the consideration of the best type of flour and bread made from it, Dr. Hamill in the No. 14 Food Report to the L.G.B. says in his *General Review*, the great practical difficulty in endeavouring to define any one variety of flour in terms of protein content, mineral content or other criteria is that such a definition to be effective would require preliminary standardisation of wheat which is impracticable in view of the fact that wheat supplies vary from different parts of the world. It is evident that, unless we live wholly on bread, which is not desirable, the differences between one bread and another do not matter much.

With regard to choice of bread for children, however (though here also a varied diet is insisted on) it is stated—" For those children who live largely on bread—there appears to be advantage in bread from flour of the '*entire' wheat class* or *from wholemeal in which the bran is very finely ground.* In these the presence of the *so-called offal, including the germ, secures a somewhat larger quantity of mineral matter and of suitably combined Phosphorus* or other substances as yet unknown, which has been proved to be of importance.

Tankard expresses his opinion definitely in favour of *white bread.* He says that after reading the statements of well-known physiologists he is convinced that wholemeal bread, brown bread and bread made from 80% flour have no advantage. The crux of the matter seems to be that before the agitation a considerable quantity of inferior grades of wheat products could be readily obtained whereas subsequently little, if any of these products were to be had. The mineral constituents make, it is thought, no difference whatever as " our daily average food intake contains far more of such material than wanted for bone-forming etc." (*Not so by any means in the case of the children of the poor.*—W.H.M.)

He suggests as standards not more than, say, 40% moisture, and that the bread shall be prepared from pure wheat flour unbleached and free from added mineral matter of any kind.

With regard to bran—it does contain a high proportion of mineral matter and of proteins but is of course excluded from white flour and also according to Tankard from the 80% flour;—in any case, the Nitrogenous constituents of the bran portion of the grain are, according to Tankard, thought to be practically non-digestible. So far as the germ of wheat is concerned this is rich in proteins, but it is doubtful how far these are, in the crude state, physiologically available to man.—P.J. ii./11,6,71.

Jago (the 'Technology of Bread-making'—1911, per P.J. ii./11,436), points out that 'Standard' Flour must include the germ of the wheat, but its enzymes give rise to objectionable changes from the very time of manufacture; excessive diastatic action is likely to occur with production of a sticky dough, and as a consequence heavy small loaves; acidity of the bread is also favoured as well as a tendency to the development of ropiness in the dough. As a set off to these objections there is the increased nutritive value of the bread.

CONCLUSIONS.—First of all the bleaching and 'improving' of flours cannot be too strongly condemned. It is, in our opinion, quite conceivable that the removal of the whole of the bran layer which contains so large a proportion of salts (see table), and which may be deemed "bone-forming" constituents, is an erroneous proceeding. Physiologists have not been able to agree on the subject—views are diametrically opposed. Extreme advocates on one side say the whole grain flour contains all the nutriment and that the white bread has nothing left in it, while the opponents of wholemeal bread appear to rely on the contention that 'offal' and the parts of the grain until now given to swine, etc., are not digestible by human beings—especially delicate children. It is obvious that a 'standard' is required both for a wholemeal and a white bread, indeed for all foods. Without intending to be too dogmatic, and with obvious limitations in the direction of preference in taste, digestibility, habit of life, etc., we are much inclined to the view that 'whole-meal' bread is the real 'staff of life,' and we are of opinion that a case has been made out for its advocacy by the profession.

## NUX VOMICA (*Off.*).

### *Assay Methods.*

U.S. standardises to 1·25% Strychnine. *U.S. Assay.* — Nux Vomica 20 Gm. in No. 60 powder is shaken with a mixture of Ether 137.5 Cc.. Alcohol 13 5 Cc., Chloroform 44 Cc. and Ammonia 5 Cc., and allowed to stand 12 hours ; 100 Cc. is decanted and shaken with repeated amounts of Normal Sulphuric Acid. Chloroform and Ammonia are added, and the mixture shaken and Chloroform drawn off. Chloroformic solution is evaporated and residue dissolved in warm Sulphuric Acid, and when cooled a cooled mixture of equal volumes Nitric Acid Sp. Gr. 1.42 (at 25° C.) and distilled water is added and the solution is shaken with Chloroform in the presence of excess of Soda. The Chloroformic solution is evaporated and the residue dissolved in N/10 Sulphuric Acid and back-titrated with N/50 Potassium Hydroxide in usual manner, using Iodeosin as indicator, the factor 0.0332 being employed to obtain percentage of Strychnine. (1 Cc. N/10 Acid = 0.03317 Gm. Strychnine.)

Alkaloidal strength, of powdered drug to be 2.5%—F.I. Standardisation for total alkaloid does not ensure the presence of any strychnine whatever Here Great Britain will probably take exception.—C.R.

Assay Method.—U.S. is satisfactory—the oxidation to proceed at a somewhat elevated temperature—50° C. being best.—Farr and Wright.—P.J. ii./06,83.

Bird's method modified for dry Extract.—P.J. ii./05,864.

A menstruum of Amyl Alcohol 1, Chloroform 3, and Ether 4 is a useful solvent for the alkaloids in assaying.—P.J. ii./00,574. A little Amyl Alcohol added to the Strychnine residue prevents decrepitation in drying.

Naylor favours a method based on Bird's or Alcock's process, concluding with Dowzard's Nitric Acid method of separating the two alkaloids.—P.J.ii./05,125. The fat of Nux Vomica is about 4%. For composition, vide P.J. ii./05,223.

The addition of 1 *Cc. of 5% solution of Sodium Nitrite* solution is suggested after dissolving the alkaloidal residue in 15 Cc. of 3% $H_2SO_4$ and adding 3 Cc. of a mixture of nitric acid and water, in the U.S. process. To ensure the oxidation of the Brucine .—Am. Jl. Ph. 1907, p. 1, *et seq.* ; Feb./08.74 ; or warm the strong acid with a few mgrs. of sugar until fumes appear, before diluting it.—A. B. Lyons, Int, Cong.

By using Nitric Acid Sp. Gr. 1.435 containing 1% Nitrogen peroxide, the Brucine is destroyed in a mixture of the alkaloids in 15 minutes.

## Extractum Nucis Vomicæ Liquidum (*Off.*).

Naylor favours a modification of the B.P. Assay process. To 5 Cc., in a separator, add Potassium Carbonate 1 Gm. in 2 Cc. water, then light petroleum spirit 15 Cc. Agitate well and run off the 2 lower layers into a separator and repeat shaking with 15 Cc. petroleum. Transfer aqueous layer to a clean separator and add the petroleum ether to portion previously obtained. Rinse second separator with 5 Cc. water and add the washings to the alkaloidal liquid in the third separator. From this liquid extract the alkaloids by three agitations with 10 Cc. of chloroform, warming after each agitation. Take the B.P. quantities of dilute sulphuric acid and water, divide into three parts, and agitate each portion successively first with the petroleum ether and then with the bulked chloroforms, assisting the chloroformic separations by warming. Collect the united acid solutions and separate the alkaloids by Dowzard's or other method.—C.D. i./07,454; P.J.i./07,395.

In the official process for estimating the liquid extract which may be employed also for the solid extract, 2 hours is sufficient for the precipitation of the Strychnine Ferrocyanide if the temperature be kept at 65° to 70° F. In cold weather the Strychnine Ferrocyanide is not properly freed from the Brucine Salt by washing.—P.J. ii./00,214.

In the U.S. process no need to evaporate the alcohol from the fluid extract taken. Shake out 5 or 10 Cc. of same direct with an immiscible solvent in presence of alkali.—Am. Ph. Jl. 1906,457.

The U.S. assay process is an improvement on that of the B.P., for the brucine is entirely destroyed by the nitric acid in ten minutes if the solution is heated to 50° C. *vide ante.*

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## OLEA ESSENTIALIA.

PROCESSES OF ASSAY OF ESSENTIAL OILS PROPOSED FOR INCLUSION IN THE APPENDIX TO THE NEXT B.P.—Hill and Umney, C.D. i/10,271.

**Saponification Process,** (*P. Off.*)., 2 to 5 Gm. of the Oil (according to the proportion of esters present) is heated for an hour with 25 Cc. of normal alcoholic potash and 25 Cc. of pure alcohol. The excess of potash is then titrated with normal sulphuric acid, and the number of Cc. required deducted from the number of Cc. required by a blank experiment conducted under the same conditions without the oil. The number of Cc. of normal potash absorbed multiplied by the ester equivalent and by 100, and divided by the quantity of oil taken, gives the percentage of esters in the oil. *Note.*—If the oil contains free acid (which must be first ascertained by experiment), the amount of alcoholic potash required to neutralise must be deducted before the ester percentage is calculated.

**Acetylation Process** (*P. Off.*).—10 Cc. of the oil is heated for 2 hours with 10 Cc. of acetic anhydride and 2 Gm. of anhydrous sodium acetate; 100 Cc. of water is added, and the aqueous layer removed by means of a separator, and the oil washed until free from acidity with successive portions of 100 Cc. of water, thoroughly shaking and allowing to separate. The acetylated oil is then dried by the addition of anhydrous sodium sulphate, and filtered; 2 to 5 Gms. of the acetylated oil is then saponified with alcoholic potash, as described under the saponification process, and the percentage of alcohol calculated from the formula $\frac{x \times Y \times 100}{W - 0{\cdot}042x}$; where $x$ is the number of Cc. of normal alcoholic potash absorbed, Y is the number of grams of alcohol equivalent to 1 Cc. of normal potash, and W is the weight of the acetylated oil taken.

*See also* Essential Oils.—C.D. i./10,63, 77, 94, 117, 151, 178, 304, 341. Refractive Index of Essential and Fixed Oils.—C.D. i./10,50.

## ANTISEPTIC POWERS OF ESSENTIAL OILS (*see* Vol. I.).

### REPLIES TO CRITICISMS.

B.M.J. ii./10,1935, enquired for details of manufacture of the Saponaceous Solutions used and pointed out that Emulsions of different Oils may vary. The figures are also criticised and the fact that Eucalyptus and Sandal Wood Oil appear so low is remarked upon.—In reply we would say that the Saponaceous Solutions were pharmaceutically prepared and from these, Emulsions were produced with water.

We agree as to the general belief that the physical conditions of such emulsions may be of importance. In support of this it is frequently pointed out in the paper that the soap present appears to assist in germicidal power, possibly by mechanical action.

We cannot agree that comparative results with Oils differ to such an extent that Emulsions of Essential Oils (made as nearly as circumstances will permit under identical conditions) may be no criterion as to relative antiseptic powers. The results give the relative strengths of certain Oils under stated conditions. Since this criticism appeared we determined very approximately with the aid of a Thoma Zeiss apparatus the size of the globules of the Oils in the Emulsion, all of dilution strength 1 in 120 and found as follows :—

| | |
|---|---|
| Gaultheria Oil .. .. .. .. | ½ to 5 microns |
| Cinnamon Bark Oil (82% Aldehyde) .. | 1 ,, 10 ,, |
| Cassia Oil .. .. .. .. .. | 1 ,, 10 ,, |
| Sandal Wood Oil .. .. .. .. | ½ ,, 5 ,, |
| Lemon Oil .. .. .. .. .. | ½ ,, 2 ,, |
| Eucalyptus Amygdalina Oil .. .. | ½ ,, 2 ,, |
| Origanum Oil .. .. .. .. | ½ ,, 5 ,, |
| Rosemary Oil .. .. .. .. | ½ ,, 5 ,, |
| Tar Oil .. .. .. .. .. | ½ ,, 2 ,, |
| Lavender Oil .. .. .. .. | Nil. |
| Eucalyptol .. .. .. .. .. | Nil. |
| Eucalyptus Globulus Oil .. .. .. | Nil. |

The minimum lethal strengths of the various Oils were in most instances less than this 1 in 120 ; this strength was found convenient to work with in the Thoma Zeiss cell. The size of the globules operating on the bacilli in the experiments may therefore be taken as certainly not larger than the dimensions stated above. It may be of interest to note that the diameter of the fat globules in cows' milk is on an average 1½ to 10 microns, hence our Emulsions may be regarded as satisfactory. The length of the Colon Bacillus is about 2 to 4 microns.

The 'general belief' may be that small globules operate more powerfully than larger ones, but we doubt whether an investigation on these lines would yield practical results, indeed it is doubtful if it could be conducted, for example, in an Emulsion of 'small' globules one would have no mean proportion of large ones, and *per contra* in an emulsion containing principally large globules there would also be an infinitely large number of minute ones, and a fair number of a medium size. The action between oil globules and bacilli may be either simply the case of the bacillus swimming into and becoming entangled in the globules or a direct killing by chemical power—what occurs is not known—it is more likely the latter. The conditions in which the results were obtained approximate those in which the Emulsions would operate in practical disinfection.

With regard to figures our B.M.J critic draws attention to the fact that we obtained a Coefficient for Origanum Oil containing 82% Carvacrol of 25.8 whilst Carvacrol as such only showed a coefficient of 21.3. It is obvious that the constituents making up the balance of 18% of the Oil may have either chemical or physical properties of value—but we would not beg the question. The difference between the Minimum Lethal Strengths as at 2 and 30 minutes, which gave the Coefficients 21.3 and 25.8 is practically negligible when one recalls the fact that we are dealing with a minute bacillus and an antiseptic under empirical conditions. For further data in answer see "Perfumery Record," Jan., 1911.

With regard to the "Lancet" criticism (Lancet, Dec. 11, 1910, p 1779) we would refer to the remarks above as to the size of the globules. The "Lancet" says :—

"The relative values of the Oils in regard to Carbolic coefficiency may not necessarily be dependent upon the essential constituent, for undoubtedly a greater inhibitory action on organisms is shown by a perfectly uniform emulsion. in which the separated particles are exceedingly fine, than by an emulsion which exhibits irregularities or suspended particles varying in dimensions." The matter might, therefore, develop into the question, What is a uniform Emulsion, and what diameter shall the oil globules have ? If cows' milk be regarded as a uniform emulsion then the Emulsions produced by our Saponaceous Solutions according to our measurements may come within this category.

The "*Lancet*" remarks that Surgeons and Physicians "are not necessarily dependent upon disagreeably smelling Phenol compounds as the basis of strong germicidal preparations."

With regard to the "*Chemist & Druggist's*" remarks, the fact that the efficacy of Eucalyptus Oils in colds and catarrhs is "not owing to bactericidal properties as measured on B. Coli Communis" is evident from the figures. It is quite likely that any kind of Eucalyptus Oil kills the influenza and catarrhal bacilli better than most other essential oils. Experiments might well be undertaken with other organisms; indeed, we instituted same with certain catarrhal organisms, and had to reluctantly drop them for the reason that we found the organisms difficult to cultivate in the conditions required—it was impossible to draw conclusions from the results. A well-defined, easily-cultivated bacterium is absolutely essential for such experiments.

## OLEUM MORRHUÆ. (*Off.*).

**Sp. Gr.** 0.924—0.931 includes all genuine samples. **Unsaponifiable Matter.** In good quality oil rarely exceeds 1.6%; use full excess of alkali before extraction; wash Ethereal Extract at least 4 times (Parry). **Free Fatty Acid** calculated as Oleic should not exceed 1%, easily estimated. Many samples fall below 0.5%. **Iodine Number** 155 to 170 (Hübl's Solution 18 hours).—P.J. ii./04, 477. *Vide also* Caspari. U.S. 140–150 for 4 hours. Fr. Cx. 140–152 ditto.

*C.R.*, 1911.—Expressed at not exceeding a temperature of 85° C. Sp. Gr. 0.920—0.930—Sapon. Val. 179–192 I. V. 155–173, Acid Value not exceeding 2.5. R.I. at 40° C. 1·4704–1.4745. Unsaponifiable matter not to exceed 1.5%. No separation of solid fat should take place on exposure of the oil to a temperature of 0° C. for three hours. 1 Cc. of the oil dissolved in 10 Cc. of Carbon Disulphide may give a violet blue colouration when gently shaken with one drop of Sulphuric Acid.

## OLEUM OLIVÆ (*Off.*).

TESTS.—Sp. Gr. 0·914 to 0.919. (*Off.*). U.S. Saponification No. 191 to 195 and Iodine No. not less than 80 or more than 88.

The action of oxygen on the oil increases the Saponification No. and reduces the Iodine No.—Am. Jl. Ph. July, '07,308.

Bird and Lucas suggested Saponification No. 188 to 197; Free Acid not to exceed 2%; R.I. at 15° C. 1.4698 to 1.4713 (varies greatly.—W.H.M.).

*C.R.* 1911.—Sp. Gr. 0·915-0·918, Saponification No. as latter, Iodine No. 79-87. Acid value not exceeding 6·0, R.I. at 40°C 1·4605-1·435.

2 Cc. of the Oil mixed with 1 Cc. of Amyl Alcohol and 1 Cc. of a 1% Solution of Sulphur in Carbon Disulphide and placed in a test tube immersed in boiling water should not develop a red colour in 15 minutes—absence of Cotton Seed Oil, *i.e. Halphen's Test* (Works better using boiling brine.—Southall's Lab. Rep. 1907.)

Other tests for absence Sesame, Arachis, Cotton and other Seed Oils similar to U.S. are provided by C.R.

The official test for Cotton Seed Oil is useless. Halphen's best.—P.J. ii./09,762.

*Renard's Test* (Archbutt modification, detailed in 'Lewkowitsch.' 3rd Edn. Vol 2, p. 6) found satisfactory for detecting adulteration (Arachis Oil).—Southall Lab. Rep. 1912.

*Test for Arachis Oil* (*U.S.*). Boil 1 Cc. of the Oil and 15 Cc. of Alcoholic $\frac{N}{1}$ KOH for 20 minutes under reflux condenser and keep 24 hours at not exceeding 15° C. A cloudiness or distinct deposit of crystals (Potassium Arachidate) would indicate presence of Arachis Oil. The test can be modified to give quantitative results.—Bohrisch—Pharm. Zeit., 1910,471.

*Test for Sesame Oil.*—2 Cc. of the Oil shaken for ½ minute with 1 Cc. of Hydrochloric Acid (*Off.*) containing 1% of Cane Sugar and allowed to stand for 5 minutes. The acid layer should not become pink (U.S. slightly modified). Our experiments showed that 5% or even less of Sesame Oil working with a pure control is quite easily detected by this test.—The reagent must be freshly prepared.

*Nitric Acid Test* for other Oils.—Agitate 5 Cc. of the oil with 5 Cc. of $HNO_3$ Sp. Gr. 1.30 heat 5 minutes. There should be no darkening and the oil should have set firm in 12 to 18 hours.

For further Tests *v.* P.J. i./07,589.

## OLEUM ROSÆ.

*Characters and Tests.*

Sp. Gr. 0·856 to 0·860 at 86° F. Congealing and melting points should lie between 19·4 and 22·2° C. Mixed with an equal volume of chloroform it does not congeal and is convenient for use. Saponification value (U.S.) not less than 10 nor more than 17. It contains 70 to 75% of Geraniol $\substack{CH_3\\CH_3}> CH - CH_2 - CH = CH - C(CH_3) = CH - CH_2 - OH$ or $C_{10}H_{18}O = 152{\cdot}98$ (154·144 I. Wts.) (three-quarters of the liquid portion), and Citronellol $C_{10}H_{20}O = 154{\cdot}98$ (156·16 I.Wts.) (the remaining 25%). The solid Stearoptene Rhodinol is odourless. Synthesis of Rhodinol.—J.C.S.A. i./1904, 756. Linalool is isomeric with Geraniol Sp. Gr. 0·870. B. Pt. 197°. It is contained in Coriander, Thyme and other oils and is either + or − rotatory.

Oleum Rosæ *C.R.* 1911.—Sp. Gr. at 30° C. (compared with water at 15° C.) 0·854 to 0·862, O.R., −2° to −4°; R.I. at 25°, 1·456 to 1·465; M.Pt., 20° to 22·5° C.

75 or 76% at most is the highest amount of alcohol calculated as Geraniol that should be allowed in a normal pure Otto.—Parry.

Pure Otto never has specific gravity as high as 0.862. Frequently it is as low as 0.850. Any Otto with a refractive index below 1·4600 is adulterated, and almost invariably with alcohol. Considering that about 50% of the adulterated samples contain alcohol, which is used to adjust the high Sp. Gr. and R.I. of the Geraniol Compounds added, the following test (invariably applied by analysts) should be included.

"If 5 Cc. be well shaken with 10 Cc. of warm water and the mixture allowed to separate, the refractive index of the washed oil at 25° C. should not differ from that of the original oil by more than 0.0015 (absence of alcohol)."

The determination of the R.I. should be made on the separated otto when quite clear, filtered if necessary, but not dried with any drying agent, since the original oil, owing to the method of distillation is saturated with water.—Parry, C.D. ii./11,450.

## OLEUM ROSMARINI (*Off.*).

Optical rotation varies enormously. The oil distilled at Hitchin has been both + and − rotatory in different years. In 1905, 6 and 7 was −0°24′:—0°36′ and −2°48′ respectively, temperature being 20° C., 20° C. and 14·5′° C. respectively. A pure oil is soluble in one-fourth its bulk of alcohol.—P.J. ii./07, 599.—P.J. ii./08.,624.

Oleum Rosmarini *C.R.* 1911.—Sp. Gr., 0.895 to 0.920, O.R., −28 to +15°, R.I., 1.463 to 1.473; Soluble 1 in 1 of 90% alcohol and 1 in 5 to 10 of 80% alcohol.

Should contain not less than 10% of alcohols, calculated as borneol and determined by the acetylation process, and at least 1·8% esters, calculated as bornyl acetate and determined by the saponification process, v.p. 58.

The suggested Rotation requirements (O.R. 0° to + 15°) exclude not only the 'Spanish (?)' Oils, but also the English. English Oil greatly superior in aroma. Further the Oil whether English or Foreign may be + or −. The English Oil Distillery should be encouraged.—P.J. ii./10,140.

## OLEUM SANTALI.

Oleum Santali *C.R.*, 1911.—Sp. Gr., 0.973 to 0.985. O.R., −13° to −21°. R.I., 1·498 to 1·508; Soluble 1 in 6 of 70% alcohol at 20° C. Should contain not less than 90% alcohols, calculated as santalol, $C_{15}H_{24}O$, when determined by the acetylation process *q.v.* *Cf.* C.D. ii./09,581; *vide* also P.J. ii./08,624.

O.R. by general concensus of opinion should be lower than given in U.S. Should be −12° to −20°. B.P. and U.S. limits are unjust, preventing many genuine oils from being sold. Solubility 1 in 5, in alcohol 70% at 30°C. and Sp. Gr. 0·965 to 0·980 at 25°C.—Am. Jl. Ph., Feb., 08,51. *Vide* also C.D. i./10,293.

O.R. never below - 16° in 1500 samples.—Parry, C.D. ii./11,451.

Sandal Wood Oils.—Am. Jl Ph., 1911, p. 335

## Copaiba. *(Off.)*.

For Maranham and Maracaibo varieties Acid number at least 75. Para and Bahia varieties contain a greater proportion of volatile oil, consequently lower acid number.—Umney, C.D. ii/09,579.

P.G.V. gives Acid No. 75·8 to 84·2, Saponification No. 84·2 to 92·7. Special directions for procedure in both cases are supplied.

**Test for Gurjun Balsam** (*q.v.*)—Dissolve four drops of the sample in 3 Cc. of glacial Acetic Acid, one drop of freshly made 10% Aqueous Potassium Nitrite Solution is added and the mixture poured carefully on to surface of 2 Cc. of Concentrated Sulphuric Acid. A dark colour always appears, but in the presence of Gurjun Balsam a violet is formed in the clear upper layer.—Am. Jl. Ph.,Jan. 08,11.

P.G.V. gives this test slightly modified, also the following for added Oils :—'Warm 1 Gm. of the Balsam on a water bath for an hour ; on cooling to room temperature a brittle resin must remain.'—Castor Oil has been used as adulterant.—Too stringent.—W.H.M.

For further details of Copaiba see Oleum Santali, *Vol. I.*

## OPIUM.

The B.P. method of estimating modified.—The difficulty of obtaining the 104 Cc. of filtrate is obviated. The Ether is not removed before collecting the precipitate on the filter, but after. Back-titration is conducted with $\frac{N}{10}$ Soda, after dissolving the Morphine in $\frac{N}{10}$ Acid,and this without drying. In estimating the tincture an error is pointed out—after treating 80 Cc. with lime, etc., it should be made up to 81·9 and not to 85 Cc. A table is given showing the equivalents of Morphine to $\frac{N}{10}$ Sulphuric Acid.—Dowzard's Process, P.J. ii./03,909. Dott's criticism of this method.—P.J. i./04,7.

Dowzard's further investigations showed it necessary to take 50·9 Cc. of the filtrate to equal 4 Gm. when working with 8 Gm. of *Opium* and 3 Gm. of slaked lime and 100 Cc. of water.

When working with 100 Cc. *Tincture* and 3 Gm. slaked lime, the final volume must be made up to 102 Cc., 50 Cc. of filtrate will then equal 50 Cc. of the original Tincture. The increase in volume due to the extractives is found by Dowzard to be lower than that given in the B.P.—P.J. i./04, 397.

The '85 Cc.' mentioned in the B.P. test is found by Farr & Wright to be correct. Experiments show that the volume should be 83·5 Cc. to 84 Cc. for Turkey Opium and 85 Cc. for Indian (Dowzard found fault with this previously, *vide* above).—C.D. i./07,266.

Ash should not exceed 4% to 8%, moisture about 12%.

Opium should be 64% water-soluble.—Ph.

Turkish, Persian, Egyptian, and Indian Opium of Commerce.—Am. Jl. Ph., April 07,156. Capsules estimated Y.B.P. 1907,131.

Estimation of Narcotine and Codeine in Opium.—Y.B.P. 1903,122.

## PANCREATINUM.

### THE EFFECT OF CERTAIN CHEMICALS AND DRUGS ON THE ACTION OF PANCREATIN.

We conducted recently as supplementary to the work on Pepsin a number of experiments to determine which chemicals and "drugs" in a selected list prevent the proteolytic action of Pancreatin under certain conditions.

The substances chosen are almost identical with those in the Pepsin experiments. In the Pancreatin series, however, we omitted the acids, as these are generally held to be incompatible. W. M. Bayliss (' Nature of Enzyme Action ') says Trypsin is practically inert in acid or neutral solution. Chittenden and Cummins however state (O. Hammarsten) that when the acid is combined with protein bodies digestion may take place rapidly when the acid combination is not in too great excess.

One quarter average doses of the substances were mixed with 5 ounces of a 3.5% Casein Solution prepared by aid of 0.35% Sodium Bicarbonate. 2 Cc. of an active Pancreatin Solution were then added. We have, therefore, the equivalent of an average dose of the " drug " in 1 pint of liquid, this bearing some relation to the conditions *in vivo*.

Milk is usually employed in standardising Pancreatin. We found it unsatisfactory and prefer the Casein method which we have arranged. Some of the chemicals in our selection cause a precipitation of the casein though the peptonising action may still proceed.

The sign + in the list indicates *complete peptonisation—i.e.*, no precipitate in the liquor on acidifying with Nitric Acid a sample removed after 1 hour at 40° C.—in other words *compatibility*.

The — sign indicates that all the casein had not been peptonised as evidenced by a pp. occurring with Nitric Acid. These experiments showing, therefore, simply + and — are not so conclusive as the Pepsin series (*q.v.*) in which quantitativo data are provided. The dilution used in the Pancreatin series is 20 times as great as that of List A in the Pepsin series. The incompatibles in the case of Pancreatin are more comparable with List C in the Pepsin experiments. The occurrence of a — sign with a drug in the Pancreatin series, together with a large proportion of undissolved albumen in the Pepsin series is interesting, as showing evidently marked physiological incompatibility.

The results were as follows :—

| Chemical or Drug. | | After 1 hour at 40°C. |
|---|---|---|
| Acetonum .. .. | 25 minims | + |
| Aether .. .. | 8 minims | + |
| Aethyl Acetas .. | 15 minims | + |
| Alcohol .. .. | 60 minims | + |
| Alum (*Off.*) .. .. | 2½ grains | + |
| Auri Chloridum .. | 1/120grain | + |
| Caffeinæ Citras .. | 1½ grains | + |
| Calcii Chloridum .. | 2½ grain | — |
| ,, Glycerophosph. | 1½ grain | + |
| Chinosol .. .. | 1 grains | + |
| Chloral .. .. | 2½ grains | + |
| Chlorodyne . .. | 2½ minims | + |
| Chloroform .. .. | 2 minims | + |
| Cocain Hydrochlor. | ⅛ grain | + |
| Codeina ,, | ¼ grain | + |
| Creosotum .. .. | ¾ minim | + |
| Cupri Sulphas .. | 1½ grains | — |
| Dec. Aloes Comp. .. | 60 minims | + |
| Elixir Aromaticum . | 15 minims | + |
| ,, Bismuthi and Pepsina .. | 15 minims | + |
| ,, Papain. .. | 15 minims | + |
| Ext. Cascaræ Liq .. | 10 minims | + |
| ,, Cinchonæ Liq. | 3 minims | + |
| ,, Cocæ Liq. .. | 10 minims | + |
| ,, Ergotæ Liq. .. | 5 minims | + |
| ,, Hydrastis Liq .. | 2½ minims | + |
| ,, Ipecac Liq. .. | 5 minims | + |
| ,, Malti Liq. .. | 30 minims | + |
| ,, Nucis Vomicæ Liq. | ½ minim | + |
| ,, Opii Liq. .. | 5 minims | + |
| ,, Suprarenal Liq. | 3 minims | + |
| ,, Taraxaci Liq. . | 15 minims | + |
| Fel Bovinum Purif. | 2½ grains | + |
| Ferri et Ammonii Citras | 2 grains | + |
| ,, Perchloridum . | 1½ grains | — |
| ,, et Quininæ Citras | 2 grains | + |
| ,, Sulphas .. | 1¾ grains | + |
| Formalin .. .. | ¼ minim | + |
| Glycerin .. .. | 20 minims | + |
| Glycosal .. .. | 5 grains | + |
| Guaiacol .. .... | ¾ minims | + |
| ,, Camphorate .. | 2 grains | + |
| ,, Carbonate .. | 1½ grains | + |
| Guarana .. .. | 8 grains | + |
| Helmitol .. .. | 2 grains | + |
| Heroin Hydrochlor. | 1/64 grain | + |
| Hexamethylenetetramine .. .. | 2½ grains | + |
| Hydrarg. Potass Iodidum .. .. | 1/100 grain | + |
| Hydrarg. Perchloridum | 1/100 grain | + |
| Hyoscinæ Hydrobromidum . .. | 1/400 grain | + |
| Iodol . .. .. | ½ grain | + |
| Jalapin .. .. | ½ grain | + |
| Liquor Ammoniæ Citratis Fort .. | 15 minims | + |
| ,, Arsenici Hydrochloric . .. | 2 minims | + |
| Liq. Bismuthi (*Off.*). | 10 minims | + |
| ,, Hamamelidis .. | 20 minims | + |
| ,, Hydrogenii Peroxidi 10 vols. | 30 minims | + |
| ,, Morphinæ Hydrochloridi .. | 8 minims | + |
| ,, Sennæ Concent. | 10 minims | + |
| Lithii Citras .. | 2 grains | + |
| Lycetol . .. | 5 grains | + |
| Magnesii Sulphas .. | 15 grains | — |
| ,, ,, | 2 grains | + |
| Manganesii Hypophosphis .. | 2 grains | — |
| Methylene Blue .. | 1 grain | + |
| Methyl Alcohol . | 4 minims | + |
| Migralgin .. | 3 grains | + |
| Naphthaline Hydrochlor .. .. | 3 grains | + |
| Paraldehydum .. | 8 minims | + |
| Phenacetin .. | 2 grains | + |
| Phenazonum .. | 2½ grains | + |
| Piperazin .. | 2 grains | + |
| Podophyllin .. | ¼ grain | + |
| Potassa Sulphurata | 2 grains | + |
| Potassii Bicarbonas . | 5 grains | + |
| ,, Bromidum . | 5 grains | + |
| ,, Chloras. .. | 2½ grains | + |
| ,, Chloridum | 5 grains | + |
| ,, Citras .. | 8 grains | + |
| ,, Iodidum .. | 2½ grains | + |
| ,, Permanganas | ½ grain | + |
| Pyramidon .. .. | 1½ grains | + |
| Pyrogallol .. .. | ¼ grain | + |
| Quinine Hydrochlor. | 1½ grains | — |
| ,, Bi-hydrochlor. | 1½ grains | — |
| Saccharin .. .. | ⅛ grain | + |
| Salol . .. .. | 2½ grains | + |
| Santonin .. .. | ¾ grain | + |
| Sodii Arsanilas .. | ½ grain | + |
| ,, Cacodylas .. | ¼ grain | + |
| ,, Chloridum .. | 5 grains | + |
| ,, Coumaras .. | ¾ grain | + |
| ,, Methyl Arsonas | ½ grain | + |
| ,, Nitris . .. | ¾ grain | + |
| ,, Sulphis. .. | 2½ grains | + |
| ,, Thiosulphas .. | 7½ grains | + |
| Stypticin .. .. | ¼ grain | + |
| Syrupus Ferri Iodidi | 10 minims | |
| ,, ,, Phosphatis | 10 minims | — |
| Terebene .. .. | 3 minims | + |
| Terpene Hydrate .. | 1 grain | + |
| Thymol .. .. | ¾ grain | + |
| Theobromin Sodio Salicyl. .. .. | 2½ grain | + |
| Thiocol .. .. | 2½ grains | + |
| Thiosinamin . .. | ½ grain | + |
| Zinci Bromidum .. | ¾ grain | — |
| ,, Sulphas .. | ½ grain | — |

It will be evident that a better view of the relative incompatibility of Pancreatin with the substances in question is obtained by comparing the Pancreatin Incompatibles with the Pepsin results (Lists A and D together) thus :—

| *Inhibit Action of Pancreatin in dilute condition.* | *Result with Pepsin in Dilute concentration—'List D' and Strong Concentration—' List A.'* |
|---|---|
| Alum (2½gr. in 5 ozs.) | Compatible (List D) |
| Calcii Chloridum (2½gr. ,, | Practically Compatible (List A). |
| Cupri Sulphas (1½gr. ,, | Compatible (List D). |
| Ferri Perchlorid (1½gr. ,, | ,, ,, |
| Magnesii Sulphas (15gr. ,, | Inhibits to Extent of 35% undissolved (List D). |
| Manganes. Hypoph. (2gr. ,, | Practically Compatible (List A). |
| Quininæ HCl (1½gr. ,, | ,, ,, ,, |
| Syr. Ferri Iodidi (10m. ,, | Compatible (List A). |
| ,, ,, Phosph. (10m. ,, | ,, ,, |
| Zinci Bromidum (¾gr. ,, | ,, (List D). |
| ,, Sulphas (½gr. ,, | ,, ,, |

### *Conclusions.*

It will be seen that these results are very similar—the total list of incompatibles is very much on the same lines in both series. The majority of the Pancreatin Incompatibles appear in the Pepsin Lists as incompatible also, though not to so marked a degree—Alum, Copper Sulphate, Ferric Chloride, Zinc Bromide, and Sulphate were more incompatible with Pancreatin than with Pepsin. Similarly, Syrup of Ferrous Iodide and Syrup of Ferrous Phosphate were incompatible with Pancreatin, whilst they were compatible with Pepsin.

Magnesium Sulphate figures as incompatible with both ferments in the same dilutions. 'Acids' in general may here be added.

*C.f.* also Pepsin Results, p. **67** *et seq.* and 'Enzyme Action,' *Vol. I.*, p. 600.

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## EXPERIMENTS TO DETERMINE EFFECT OF CHEMICALS ON THE AMYLOLYTIC ACTION OF PANCREATIN.

It seemed of interest to determine the amylolytic activity of a *Pancreatin which had been found to be weak in proteolytic power* and then subsequently to determine the inhibitory effect of drugs on the amylolysis.

With regard to the first point it was found that the sample of Pancreatin in question was well up to Standard when tested for amylolytic power ; and a certain liquid preparation of commerce, which had strong proteolytic power, was found to be practically useless for amylolysis *C.f.* Malt Diastase Results.

As to the second point, 0·4 Gm., of the Pancreatin, weak in proteolytic power, was mixed with 10 Cc. of Water, and added to Starch 7·5 Gm. gelatinised in water 150 Cc. (made almost transparent by boiling and cooling)—the amount of medicament having been previously added to this Starch mixture.

After 5, 15 and 30 minutes the liquors were tested with dilute Iodine Solution on the lines of the U.S. P. Test. Results were as follows :—

| | | 5 minutes. | 15 minutes. | 30 minutes. |
|---|---|---|---|---|
| Acid Aceto-Salicylicum | 2½ gr. | | — | — |
| ,, Gallicum | 2½ gr. | + | | |
| ,, Hydriodicum Dil. | 2½ m. | + | partial. | partial. |
| ,, Hydrobromicum | 7½ m. | | — | |
| ,, Hydrochlor. Dil. | 2½ m. | — | — | — |
| ,, Salicylicum | 2½ gr. | + | | |
| ,, Tannicum | 2½ ,, | — | — | — |
| Alum (Potash) | 2½ ,, | partial. | partial. | + |
| Caffeinæ Citras | 1¼ ,, | partial. | partial. | + |
| Cupri Sulphas | 1½ ,, | — | — | partial. |
| Ferri Perchloridum | 1½ ,, | — | — | — |
| Piperazine | 2½ ,, | — | partial. | partial. |
| Potassa Sulphurata | 1¼ ,, | + | | |
| Potassii Bicarbonas | 20 ,, | + | | |
| Syr. Ferri Iodidi | 10 m. | + | | |
| ,, ,, Phosph. | 10 m. | + | | |
| Zinci Bromidum | ¾ gr. | + | | |
| ,, Sulphas | ½ gr. | + | | |

## PARAFFINUM LIQUIDUM (*Off.*).

It may be used in place of Cedar Wood Oil for lens immersion.—Rowntree.

There is no better **mounting medium for bacteria.** The refractive index of bacteria is said to be 1.55, Canada Balsam 1.538, Balsam in Xylol a little lower say 1.53, Distilled Water 1.336, Liquid Paraffin 1.471. In a medium exactly that of the bacteria, *e.g.*, Oil of Aniseed 1.55 the bacteria (dried) but unstained would be invisible, in Canada Balsam they would be seen, in Paraffin better and in Water best. Flagella of bacteria and spirochaetae which were known to possess same, as well as the flagella of the tubercle bacillus and M. Melitensis (which are commonly supposed not to possess them) were taken in some test experiments. The visibility of same (the bacteria being stained by ordinary stains, not flagella stains) depended largely on the mounting medium used. These were not easily seen in media of *very high or very low* R.I., but these media caused very rapid fading. Of all practical media Parolein was found to be best. Liquid Paraffin is, however, not so good as Cedar Wood Oil for lens immersions.—A.C.Coles —L.i./11,877.

## PEPSINUM (*Off.*), U.S., etc.

### *Assay Methods.*

**Fr. Cx.** requires that the Pepsin shall convert 25 times its weight of dried fibrin. Pepsin 0·1, Dilute Hydrochloric Acid 1·5, Water 58·5, Fibrin 2·5 for 9 hours at 50°. Test filtrate with Nitric Acid. Pepsin Amylacée and Pepsin Lactosée in dose 0·25 Gm. are to contain sufficient Pepsin to carry out the above test.

Assay of Pepsin by the Biuret reaction.—P.J.i./07,198; C.D. i./07,300.

Hereod and Maben, comparing the official methods in various countries, suggest as an International standard 1 to 2,000 and *Assay Method* as follows:

Coagulated white of egg (obtained by boiling fresh eggs for ten minutes), pass through a No. 40 sieve, and press between two sheets of filter-paper to remove surplus moisture; place 10 Gm. in a 200 Cc. flask, containing 100 Cc. of distilled water previously heated to 52° C., 0.25 per cent. absolute HCl, and 5 Cc. of a 0.1 per cent. solution of pepsin. Place the flask in a water-bath at 52° C., and digest at that temperature for two hours, stirring gently every fifteen minutes with a rotatory movement by means of a glass rod. At the expiration of two hours the albumin should be dissolved, the solution having an opalescent appearance.—P.J. ii./10,368; C.D. ii./10,371.

It is stated (Maben and Walker C.D. Sept. 3. 1910, p. 41), that on digesting albumin with Pepsin (in acid solution) the albumin is not entirely converted into Peptone—on the contrary, firstly, Syntonin and secondly Proteose (Albumose) are formed prior to Peptone: even if the digestion is carried on for as long as 144 hours rarely " more than 45% of true peptone is in solution."

The Syntonin can be demonstrated by neutralising the acid solution with alkali—whitish precipitate

The albumose can be shown by treating with hot saturated solution of Ammonium Sulphate.

**Carmino-fibrin**, prepared by washing blood fibrin with ammoniacal solution of carmine, is a dark coloured mass, easily crumbled, which yields no colour to water or 0.1% Hydrochloric Acid until the fibrin contained in it has been dissolved by a ferment; hence its use as a simple quantitative test for pepsin by noting the time required to give a pink colour equal to that of a standard or control.

## THE EFFECT OF CERTAIN CHEMICALS AND DRUGS ON THE ACTION OF PEPSIN.

The following experiments which we have recently conducted show approximately the relative inhibitory action *in vitro* which certain chemicals and drugs have on the digestive power of Pepsin. The conditions under which the experiments were conducted were as follows:—

Three Gm. of Egg Albumen, prepared as for testing Pepsin (*Off.*), were placed in 30 Cc. of Hydrochloric Acid 0.2%. An average dose (in most cases) of the drug was added, followed by 1 Cc. of freshly prepared Pepsin Solution containing 0.2% of Pepsin (*Off.*). These mixtures were then incubated at 38° C. for fifteen hours, this length of time being allowed to permit of the Pepsin utilising its power to the utmost. It is to be noted that 30 Cc. of fluid is a minute amount in comparison with the capacity of the human stomach, but the results are comparable, and it is evident that if the drugs in question do not interfere with peptic activity in this strong concentration, they are certainly not likely to do so when more diluted. On the other hand, if peptic activity is interfered with, there is evidence of physiological incompatibility—though it may be of less magnitude than the figures suggest.

List A.

| Chemical or Drug. | Undissolved Albumen after 15 hours. | Percentage Undissolved. |
|---|---|---|
| | Gm. | |
| Acetone 90 minims | 1.5 | 50.00 |
| ,, 45 minims | 0.10 | 3.33 |
| ,, 30 minims | Trace. | Negligible |
| Acid Aceto-Salicyl 10 grains | 0.05 | 1.66 |
| ,, Aceto-Coumaric 10 grains | 0.34 | 11.33 |
| ,, Benzoic 10 grains | 0.03 | 1.00 |
| ,, Boric 10 grains | 0 00 | 0.00 |
| ,, Cacodylic 2 grains | 0.20 | 6.66 |
| ,, Carbolic 3 grains | 0.20 | 6.66 |
| ,, Citric 5 grains | 0.40 | 13.33 |
| ,, Coumaric 10 grains | 0.30 | 10.00 |
| ,, Gallic 10 grains | 0.15 | 5 00 |
| ,, Hydriodic Dil. 10 minims | 0.40 | 13 33 |
| ,, Hydrochloric Dil. *Off.* 6 minims | 0.10 | 3.33 |
| ,, Hydrobromic *Off.* 30 minims | 0.35 | 11.66 |
| ,, Hypophosph. Dil. 8 minims | 0.10 | 3.33 |
| ,, Phosph. Conc. *Off.* 4 minims | 0.10 | 3.33 |
| ,, Salicylic 5 grains | 0.15 | 5.00 |
| ,, Sulphurosum *Off.* 30 minims | 0.15 | 5.00 |
| Æther 30 minims | 0.05 | 1.66 |
| Æthyl Acetas 1 drachm | 0.50 | 16.60 |
| Alcohol 90% 4 drachms | 2.65 | 88.33 |
| ,, 90% 2 drachms | 1.00 | 33.33 |
| ,, 90% 1 drachm | 0.40 | 13 33 |
| ,, 90% 10 minims | 0.24 | 8 00 |
| Alum *Off.* 10 grains (Potash) | 2.00 | 66.66 |
| Auri Chloridum 1/30 grain | 0 00 | 0.00 |
| Bismuth see Liquor Bismuthi | | |
| Caffeinæ Citras 5 grains | 0.04 | 1.33 |
| Calcii Chloridum 10 grains | 0.30 | 10.00 |
| ,, Glycerophosph. 5 grains | 0.00 | 0.00 |
| Chinosol 3 grains | 0.95 | 31 66 |
| Chloral Hydras 10 grains | 0.30 | 10.00 |
| Chloromorphiæ Liquor 10 minims | 0.10 | 3.33 |
| Chloroform 8 minims | 0.10 | 3.33 |
| Cocainæ Hydrochloridum ½ grain | 0.00 | 0 00 |
| Codeinæ Hydrochloridum 1 grain | Trace. | Negligible |
| Creosotum 3 minims | 0.25 | 8.33 |
| Cupri Sulphas 5 grains | 1.20 | 40.00 |
| Decoctum Aloes Comp. ½ ounce | 1.00 | 33.00 |
| Elixir Aromaticum 1 drachm | Trace. | Negligible. |
| ,, Papain 1 drachm | 0.14 | 4.66 |
| Ext. Cascaræ Liquidum 45 minims | 0.20 | 6.66 |
| ,, Cinchonæ Liquidum 12 minims | Trace. | Negligible |
| ,, Cocæ Liquidum 45 minims | ,, | ,, |
| ,, Ergotæ Liquidum 22 minims | ,, | ,, |
| ,, Hydrastis Liquidum 10 minims | ,, | ,, |
| ,, Ipecac. Liquidum 17 minims | ,, | ,, |
| ,, Malti Liquidum 2 drachms | 3.00 | 100.00 |
| ,, Nucis Vom. Liq. 2 minims | Trace. | Negligible. |
| ,, Opii Liq. 20 minims | 0 24 | 8.00 |
| ,, Suprarenal Liq. 12 minims | 0.49 | 16.33 |
| ,, Tarax. Liq. 1 drachm | 1.61 | 53.66 |
| Fel Bovinum 10 grains | 3.00 | 100.00 |
| Ferri et Ammon. Cit 7½ grains | 2 73 | 91 00 |
| ,, et Quininæ Cit. 7½ grains | 3.00 | 100.00 |
| ,, Perchloridum 6 grains | 2.40 | 80.00 |
| ,, Sulphas. 3 grains | 1.66 | 55.33 |

List A—*continued.*

| Chemical or Drug. | Undissolved Albumen after 15 hours. | Percentage Undissolved. |
|---|---|---|
| | Gm. | |
| Formalin 1 minim .. .. .. | 0.43 | 14.33 |
| Glycerin 1½ drachms .. .. .. | 0.28 | 9.33 |
| Glycerin. Trypsin 1½ drachms .. .. | 0.40 | 13.33 |
| Glycetract Calumbæ 15 minims .. | 0.10 | 3.33 |
| Glycosal 17½ grains .. .. .. | 1.12 | 37.33 |
| Guaiacol 3 minims .. .. .. | 1.51 | 50.33 |
| Guaiacol Camphoras 7½ grains .. .. | Trace. | Negligible. |
| Guaiacol Carbolas. 5 grains .. .. | ,, | ,, |
| Guarana 35 grains .. .. .. | ,, | ,, |
| Helmitol 7½ grains .. .. .. | 1.76 | 58.66 |
| Heroin Hydrochlor. 1/20 grain .. | 0.00 | 0.00 |
| Hexamethylene tetramine 10 grains .. | 1.50 | 50.00 |
| Hydrargyri Potass. Iodid. 1/24 grain .. | 0.00 | 0.00 |
| ,, Perchloridum 1/24 grain .. | 0.00 | 0.00 |
| Hyoscinæ HBr. 1/100 grain .. .. | 0.00 | 0.00 |
| Iodol. 2 grains .. .. .. .. | Trace. | Negligible. |
| Jalapin. 2 grains .. .. .. .. | 1.30 | 43.33 |
| Liquor Ammonii Citras Fort. 1 drachm | 2.30 | 76.66 |
| Hydrogenii Peroxidi Liquor ('10 vol.') 2 drachms .. .. .. .. | 0.00 | 0.00 |
| Liq. Arsenii Hydrochloricus 8 minims | 0.05 | 1.66 |
| ,, Bismuthi *Off.* 45 minims .. .. | 0.50 | 16.66 |
| ,, Hamamelidis 1½ drachms .. .. | 0.00 | 0.00 |
| Morphinæ Hydrochlor 30 minims | Trace | Negligible |
| ,, Sennæ Conc. *Off.* 45 minims .. | 2.40 | 80.00 |
| Lithii Citras 7 grains .. .. .. | 1.80 | 60.00 |
| Lycetol 20 grains .. .. .. .. | 2.10 | 70.00 |
| Magnesii Sulphas 1 drachm .. .. | 1.90 | 63.33 |
| ,, ,, 10 grains .. | 1.15 | 38.33 |
| Manganesi Hypophosph. 7 grains .. | 0.40 | 13.33 |
| Methylene Blue 4 grains .. .. .. | 0.19 | 6.33 |
| Methyl Alcohol 17 minims .. .. | Trace | Negligible |
| Migralgin 12 grains .. .. .. | 0.20 | 6.66 |
| Naphthalini Hydrochlor. 9 grains .. | 0.00 | 0.00 |
| Pancreatin 4 grains .. .. .. | 0.00 | 0.00 |
| Paraldehydum 30 minims .. .. | 1.60 | 53.33 |
| Perhydrol 30 minims .. .. .. | 0.00 | 0.00 |
| Phenacetinum 7 grains .. .. .. | 0.00 | 0.00 |
| Phenazonum 10 grains .. .. .. | 1.40 | 46.66 |
| Phosphorus 1/50 grain .. .. .. | 0.00 | 0.00 |
| Physostigminæ Sulph. 1/40 grain .. | 0.00 | 0.00 |
| Picrotoxin 1/50 grain .. .. .. | 0.00 | 0.00 |
| Pilocarpin Nitras 1/20 grain .. .. | 0.00 | 0.00 |
| Piperazina (Base) 7 grains .. .. | 2.45 | 81.66 |
| ,, (neutralised with HCl) 7 grains .. .. .. | 0.73 | 24.33 |
| Podophyllin 1 grain .. .. .. | 0.00 | 0.00 |
| Potassa Sulphurata *Off.* 6 grains .. | 2.60 | 86.66 |
| ,, ,, (Neutralised with HCl, .. .. .. .. | 1.90 | 63.33 |
| Potassii Bicarbonas 20 grains .. .. | 1.70 | 56.66 |
| ,, Bromidum 20 grains .. .. | 1.64 | 54.66 |
| ,, Chloras 10 grains .. .. | 1.14 | 38.00 |
| ,, Chloridum 5 grains .. .. | 1.20 | 40.00 |
| ,, ,, 10 grains .. .. | 2.10 | 70.00 |
| ,, ,, 20 grains .. .. | 2.40 | 80.00 |
| ,, Citras 30 grains .. .. | 1.66 | 55.33 |
| ,, Iodidum 10 grains .. .. | 1.90 | 63.33 |
| ,, Permanganas 2 grains .. .. | 1.70 | 56.66 |

List A—*continued.*

| Chemical or Drug. | Undissolved Albumen after 1 5 hours<br>Gm. | Percentage Undissolved. |
|---|---|---|
| Pyramidon 5 grains .. .. .. | Trace. | Negligible |
| Pyrogallol. 1 grain .. .. .. | .. | ,, |
| Quininæ Hydrochlor. 5 grains .. .. | 0.30 | 10.00 |
| Saccharin ½ grain .. .. .. | 0.42 | 14.00 |
| Salol 10 grains .. .. .. .. | 0.60 | 20.00 |
| Santonin 3 grains .. .. .. | 0.40 | 13.33 |
| Sodii Arsanilas 2 grains .. .. .. | 0.20 | 6.66 |
| ,, Cacodylas 1 grain .. .. | 0.13 | 4 33 |
| ,, Chloridum 5 grains .. .. | 0.80 | 26.66 |
| ,, ,, 10 grains .. .. | 1.50 | 50.00 |
| ,, ,, 20 grains .. .. | 1.70 | 56.66 |
| ,, Coumaras 3 grains .. .. | 2.90 | 96.66 |
| ,, Methyl-Arsonas 2 grains .. .. | 0.40 | 13.33 |
| ,, Nitris 1½ grains .. .. .. | 2.40 | 80.00 |
| ,, Sulphis 10 grains .. .. .. | 2.50 | 83.33 |
| ,, Thiosulphas 30 grains .. .. | 1.20 | 40.00 |
| Stypticin 1 grain .. .. .. .. | Trace. | Negligible. |
| Syrupus Ferri Iodidi *Off.* 30 minims .. | 0.00 | 0 00 |
| Terebenum 10 minims .. .. .. | 0.10 | 3.33 |
| Terpini Hydras 4 grains .. .. .. | 0.30 | 10.00 |
| Terpinol 3 minims .. .. .. | 0.10 | 3 33 |
| Theobromina 3 grains .. .. .. | Trace. | Negligible. |
| Theobrominæ Sodii Salicyl. 12 grains .. | 2.05 | 61.66 |
| Thiocol 10 grains .. .. .. .. | 2.45 | 81.66 |
| Thiosinamin 1½ grain .. .. .. | Trace. | Negligible. |
| Thymol 1½ grains .. .. .. | 1.80 | 60.00 |
| Zinci Bromidum 3 grains .. .. | 1 45 | 48.33 |
| , Sulphas. 2 grains .. .. .. | 1.46 | 48.66 |
| Control .. .. .. .. .. | Nil. | Nil. |

These results are exceedingly interesting, as they tend to solve a vexed problem—to wit, the physiological incompatibility of a number of substances with Pepsin.

It is notable, for example, that the following apparently ***do not interfere*** with peptic activity to any extent :—

List B.

Acetonum small dose.
Acidum Aceto-Salicylicum.
,, Benzoicum.
,, Boricum.
,, Cacodylicum.
,, Carbolicum.
,, Gallicum.
,, Hydrochloricum.
,, Hypophosphorosum Dilutum.
,, Phosphoricum.
,, Salicylicum.
,, Sulphurosum.
Æther.
Alcohol, small proportion.
Auri Chloridum.
Caffeinæ Citras.
Calcii Glycerophosphas.
Chloromorphiæ Liquor.
Chloroformum.
Cocainæ Hydrochloridum
Codeinæ Hydrochloridum.
Elixir Aromaticum.
,, Papain.
Extractum Cascaræ Liquidum.
,, Cinchonæ Liquidum.
,, Cocæ Liquidum.
,, Ergotæ Liquidum.
,, Hydrastis Liquidum.
,, Ipecacuanhæ Liquidum.
,, Nucis Vomicæ Liquidum
Glycectractum Calumbæ.
Guaiacol Camphoras.
,, Carbonas.
Guarana.
Heroin Hydrochloridum.
Hydrargyri Perchloridum.
,, et Potassii Iodidum.
Hydrogenii Peroxidum.
Hyoscinæ Hydrobromidum.
Iodol.
Liquor Arsenici Hydrochloricus
,, Hamamelidis.

Liquor Morphinæ Hydrochloridi.
Magnesii Sulphas. (*small* dose.)
Methyl Alcohol.
Methylene Blue.
Migralgin.
Naphthalini Hydrochloridum.
Pancreatinum.
Perhydrol.
Phenacetinum.
Phosphorus.
Physostigminæ Sulphas.
Picrotoxinum.
Pilocarpinæ Nitras.
Podophyllin.
Pyramidon.
Pyrogallol.
Sodii Arsanilas.
,, Cacodylas.
Stypticin
Syrupus Ferri Iodidi.
Terebenum.
Terpinol.
Theobromina
Thiosinamin.

In arriving at the above conclusion we took, in most cases, 6.6 %, or less *undissolved* to indicate in the conditions of the test ***physiological compatibility***. The gradation of figures in respect of the different amounts of Alcohol (see Table) is particularly interesting and instructive. The fact that **Acids** in general other than Hydrochloric are seen to be compatible is of interest. The compatibility of **Chloroform** is well known to physiological chemists. Other ointeresting and perhaps unexpected *compatibles* are **Creosote Ether, Guaiacol preparations, Mercuric Chloride** (in dose specified), **Hydrogen Peroxide, Sodium Arsanilate.**

The *following*, on the other hand, *inter alia*, appear to ***prevent peptic action*** if present in strong proportion :—

LIST C

Acetonum, large proportion.
Alcohol, large proportion.
Alkalis.
Alumen.
Cupri Sulphas.
Extractum Malti.
Fel Bovinum.
Ferri et Ammonii Citras.
,, et Quininæ Citras.
,, Perchloridum.
,, Sulphas.
Guaiacol.
Hexamethylentetramin .
Jalapin.
Liquor Ammonii Citratis Fortis
,, Sennæ Concentratus
Lithi Citras
Magnesi iSulphas, in large dose
Paraldehydum.
Phenazonum.
Piperazina (Base).
Potassa Sulphurata (neutralised with Hydrochloric Acid.)
Potassii Bromidum.
,, Chloras.
,, Chloridum
,, Citras.
,, Iodidum.
,, Permanganas.
Sodii Chloridum,—a considerable amount.
,, Nitris.
,, Sulphis.
,, Thiosulphas.

Amongst this series of particular interest are the results with **Alcohol, Sodium** and **Potassium Chlorides** (the Potassium Salt no better than the Sodium analogue), also **Hexamethylenetetramine** and **Magnesium Sulphate.** But one must take into account the comparatively strong concentrations in which we were working (an average dose of the drug in 30 Cc. of Peptonising Fluid) and the fact that such concentrations would hardly occur in practice. Nevertheless, as already stated, the evidence of these physiological incompatibilities is of value especially when the results *are compared* with the previous series, *i.e.*, the *relatively compatible* medicines.

We next tested whether the drugs that are incompatible in *strong* proportion (average dose in 30 Cc.) would *exhibit similar effect when present in a volume of Liquid bearing more resemblance with that encountered in the human digestive tract.*

For this purpose the drugs required from "List C" with some additions from "List A" were treated as follows :—

14.2 Gm. Egg Albumen prepared as before were placed in 150 Cc. of Hydrochloric Acid 0.2% containing 10 mgr. of Pepsin and ¼ of an average dose (in most cases) of the drug was added. In other words, the conditions of the test are identical with those at the outset except that we have here the equivalent of the average dose of the drug approximately in a *pint* of the Liquor, whilst previously it was present in about an *ounce* (30 Cc.).

The results were as follows :—

LIST D.

| Chemical or Drug. | Undissolved Albumen after 15 hours. | Percentage. undissolved |
|---|---|---|
| Alum, 2½ grains | Nil | Nil |
| Cupri Sulphas 1½ grains | Nil | Nil |
| Ext. Malti Liq. 30 minims | Nil | Nil |
| Fel Bovinum Purif. 2½ grains | 0.4 Gm. | 2.8% |
| Ferri et Ammon. Citras 2 grains | Nil | Nil |
| ,, et Quinin. Citras, 2 grains | Nil | Nil |
| Ferri Perchloridum 1½ grains | Nil | Nil |
| ,, Sulphas, ¾ grain | Nil | Nil |
| Helmitol, 2½ grains | Nil | Nil |
| Hexamethylentetramine 2½ grains | 1.7 Gm. | 11.9% |
| Liq. Ammon. Citrat. Fort., 15 minims | 11 5 Gm. | 81.% |
| Magnesii Sulphas, 15 grains | 5 Gm. | 35% |
| Paraldehydum, 8 minims | Nil | Nil |
| Phenazonum. 2½ grains | Nil | Nil |
| Piperazina (base), 2½ grains | Nil | Nil |
| Potassa Sulphurata, 1½ grains | 0.5 Gm | 3.5% |
| Sodii Nitris, ⅓ grain | Trace | Negligible |
| ,, Sulphis, 2½ grains | Nil | Nil |
| ,, Coumaras, ¾ grain | Nil | Nil |
| Thiocol, 2½ grains | Nil | Nil |
| Zinci Bromidum, ¾ grain | Nil | Nil |
| ,, Sulphas, ½ grain | Nil | Nil |
| Control | Nil | Nil |

*Conclusions.*

*Dilution* of the chemical or drug, therefore, plays a very important part in the matter. All the incompatible substances indicated in 'List C' were under exceptional circumstances of concentration.

'List D' shows that in the presence of a larger volume of diluent fluid the substances incompatible with Pepsin are greatly reduced in numbers, but the result in the case of **Magnesium Sulphate** is of peculiar interest. The proportions of undissolved albumen shown by the other substances in this list are negligible, or may be chemically explained.

It must not be forgotten that nature might compensate effects produced by chemicals in a manner which it is impossible to imitate in such experiments.

At the same time it must not be overlooked that under certain conditions, *e.g.* ill health, or an empty stomach, the volume of diluent fluid might be greatly reduced, hence the 'List A,' and in particular 'List C,' will be of value to the physician, *firstly*, as showing where incompatibility with the patient's peptic activity may be expected, and *secondly* when prescribing pepsin preparations, as showing what to avoid. These results may be compared with the analogous Pancreatin data.—*v.* also Malt, p. 40.

See also 'Enzyme Action' *Vol.* I. p. 600.

REFERENCES. Allen *Vol.* IV. (1898) to the investigations of Symes, Chittenden Schiff, Wroblewski, and others; Also W. M. Bayliss & O. Hammarsten.

## PIX LIQUIDA.

### Oleum Cadinum.

The following *Characters and Tests* are suggested :—

A vegetable tar obtained by dry distillation of *J. Oxycedrus*, of brownish red colour, transparent, clear and homogeneous aspect, has a wood-smoke-like odour, with a density inferior to water. It is almost *insoluble* in Water, but gives it an acid reaction, partly soluble in cold Alcohol, completely soluble in hot Alcohol (90 %), in Ether, Chloroform and Carbon Bisulphide. The acidity expressed as Acetic Acid must not exceed 1.5 per 100Cc. It must be free of other Tars and particularly not give the **Copper Acetate Test for foreign Wood Tars and Resins.**—Shake out with Petroleum Ether, filter and shake filtrate with equal volume of 1% solution of Copper Acetate; the Petroleum layer is coloured green if wood tar be present.—Perfumery and Essential Oil Record, April, 1911,—P.J. i./11,567.

We found on testing an assumed genuine sample, which gave no indication by itself, that *at least* 20% of Wood Tar (Stockholm) had to be added to give a definite green color to the dark supernatant liquor. There was no appreciable difference between the sample and the same adulterated with 10% of Stockholm Tar. Oleum Betulæ Pyroligneum gave a deep olive green color. Creosote, Phenol and Oleum Picis Rectificatum were tested and found to give no colour at all.

*Uses.*—Recommended in eczema and other skin affections, also for gout and rheumatism.

## PLUMBUM.

### *Lead Poisoning.*

Lead poisoning and the race.—Amongst a host of facts and fancies put forward, the following appears. Where (in Hungary) death from convulsions in early infancy rarely occurs, epilepsy is found later on to be more frequent in the children of potters than in those of non-potters.—B.M.J. i./11,1096.

Lead poisoning in all forms well treated by Calcium Permanganate in doses of ¼ grain.—B.M.J., May 14,/10,1166.

English Potteries, Lead Poisoning in, Home Office Report on.—B.M.J ii./11,44. See also Na. Dec 29, 1910, p. 273—a review on dangers attendant on the use of Lead and injury to health from dust and other causes in the manufacture of earthenware and china, etc. "It cannot be said that any real progress has been made. Although a large amount of earthenware can be made without the use of any lead, and even in the cases where lead must be used, it has been proved that the lead may be so combined that it is practically innocuous, the manufacturers as a body have hitherto resisted any attempt to prescribe a schedule of articles which should be made with leadless glaze, or to bind themselves to use glazes in which the lead is in an innocuous form. They demand unrestricted liberty to use any materials they think necessary for their purposes. The loud cry of "foreign competition" is sufficient to drown the still small voice of pity on behalf of the workers. . . . . Lead glaze is the main source of the evil. The net upshot of the inquiry is that the whole position is not one whit ameliorated; the operatives apparently are still to remain the victims of lax surveillance or of indifference, and of official non-interference. If the manufacturers' claim for unrestricted liberty is to be allowed they must be made to feel the responsibility they thereby incur by far more stringent measures than have hitherto been brought to bear upon them."

## PRUNI VIRGINIANÆ CORTEX (*Off.*).

Identification of various Spurious Cherry Barks. *P. Avium* is paler; taste bitter and astringent. Almond odor scarcely perceptible. *P. Pennsylvanica*, red brown, taste scarcely bitter. *P. Virginiana*. The bitter almond flavour is more perceptible than in any except *P. Serotina*.—Holmes P.J. i./09,192.

The bark yields 0·075% of its weight HCN.—B.C.D. ii./09,131.

Chemical examination of a species of *Prunus*, said to be closely allied to *Prunus emarginata*. The constituents, amongst which is Prunetin, a new dihydric phenol $C_{16}H_{12}O_5$, appear to bear no relation to those known to be in *P. serotina*—this substitute for the genuine article differs in that when moistened with water there is no formation of Benzaldehyde and Hydrogen Cyanide as with the genuine bark.—P.J. ii./10,604.

### Syrupus Pruni Virginianæ (*Off.*).

Hallaway finds the B.P. method extracts 35%, Cline's 50%, Beringer's (with Glycerin), about 70% of the hydrocyanic acid. Glycerin extracts Tannin. The B.P. method is easy to work. Clines's process—which consists in macerating the bark 2 to 4 hours at 60° C., then percolating, adding Glycerin to the percolate and finally dissolving the sugar, is thought best. This reduces the Tannin content and increases the HCN, the enzyme being more active at the higher temperature, but even in the strongest syrup the HCN strength is only 0.008 per cent., or roughly 1/13, the strength of Cherry-Laurel Water.—P.J. i./09,798.

It is recommended to modify the U.S. process by packing and macerating the moistened powder in a percolator 24 hours with water *q.s.* to submerge and to percolate until the receiver containing the Glycerin contains 600 Cc. of liquid at least. U.S. has a considerable error here.—Am. Jl.Ph. July /09,316.

## RADIOLOGY.

### Ultra-Violet Rays.

WATER STERILISATION.

Bacteria in water can be killed with remarkable speed by ultra-violet Rays. The Cooper Hewitt Apparatus provides 132 gallons of sterile water per hour. —L. ii./10,1784 gives particulars of experiments conducted with an improved type of the apparatus. With a flow of more than 600 cubic meters per 24 hours through the machine, and a consumption of less than 26 Watts per cubic metre, a content of 500 to 1,000 B. Coli per litre and total germs of 20 to 260 germs per cc. in the in-flow; the B. Coli were reduced to nil and the "germs" to practically nil in the out-flow. There would appear to be a wide and great future for this new system. It destroys both pathogenic and non-pathogenic organisms and all spores.

14 specimens of water treated by the ultra-violet rays were absolutely sterile. L. ii./11,779.

The rays from the quartz-mercury lamp colour manganese glass violet within 12 hours. It is suggested that the mixture of Ferric and Manganous Silicate become changed into Ferrous and Manganic Silicate.—C.D. i./05,756; L. i./05, 512.

On a method of producing ultra-violet rays by low tension high frequency currents.—L. i./06,587.

**Mercury Vapour Lamps**, violet and ultra-violet rays from, have considerable germicidal effect on an organism like *B.prodigiosus*.—Hewlett, L. i./09,743.

Milk can be sterilised by this means.—L. i./09,798.

The proportion of ultra violet Rays emitted by a given Lamp depend greatly on whether it is water-cooled or not and also upon the age of the lamps. —Na. July 1911, p. 102.

The action of the ultra-violet Rays of the Mercury Lamp on *Citrate of Silver Paper* s parallel with the bactericidal action upon *Bacillus Coli* and the yield of such a lamp when used for sterilising purposes may be very conveniently controlled by such papers.—Na. Aug. 1811, p. 169.

A solution of Ammonium Nitrate under the action of ultra-violet light forms some Nitrite. The effects of ultra-violet light are generally similar to those of ferments.—Na. Mar 1911,68.

The ultra-violet radiation of the Mercury Lamp is more intense as the temperature of the luminous tube increases. For experiments in photo-chemistry the lamp may be relied upon as a constant source of ultra-violet rays, the radiation being defined when the voltage, amperage and length of tubes are known.—Na. Aug. 1911, 272.

The action of ultra-violet rays on certain toxic substances. Cobra venom is rapidly destroyed by exposure to these rays. Strophanthins have their activity markedly diminished by exposure to the rays for 30 to 120 minutes. Saponin completely loses its hæmolysing power after such exposure.—P.J. ii./11,779.

## RHEI RADIX.

Rhubarb, constituents of. By treatment of an aqueous solution with ether and other solvents, cinnamic and gallic acids, rhein, a new anthraquinone derivative $C_{17}H_{10}O_6$ termed rheinolic acid, emodin, aloe-emodin (not previously observed), emodin mono-methyl ether and crystalline chrysophanic acid were obtained. An amorphous non-glucosidic resin is the principal purgative constituent.—P.J. i./11,529. See also P.J. i./07,587. *Rheum Palmatum*, the source of Medicinal Rhubarb.—P.J. ii./11,429.

P.G.V should yield 35% extract on macerating 24 hours with a mixture of equal parts alcohol and water.

*Colorimetric Assay.*—All good rhubarbs containing from 2.8 to 4% of oxy methyl-anthraquinones are said to comply with the test given in P.J. ii./05,580.

## SACCHARUM.

Two lumps of *pure Cane* Sugar rubbed together in the dark produce luminosity.—B.M.J. i./11,752.

**Cane Sugar** may (in the absence of a polarimeter) be approximately estimated by heating 1 Gm. of the same in 50 Cc. of water, to which 10 drops of hydrochloric acid have been added, for half an hour on a water bath. The solution is then cooled and neutralised with soda and made up to 100 Cc. with water, and the Invert Sugar thus formed is estimated with Fehling's Solution, 1 Cc. of which is approximately equivalent to 0·005 Gm. of Invert Sugar, the calculation being on the basis that 360 of Invert Sugar represent 342 of Cane Sugar.

Estimation. — A 10% solution at 20° has $[\alpha]_D = + 66{\cdot}486°$.—P.J. ii./04,714.

Decomposition products of sugars as effected by various oxidising agents. Formic acid, a very small quantity of acetaldehyde and apparently glycuronic acid formed —L. ii./11,1418.

## SAPONES.

In soap-boiling caustic soda of high purity, 96-98%, is used for the best varieties. The lye employed (into which the melted fat is poured) has Sp. Gr. 1·075. Boiling proceeds with occasional further addition of lye.

The chemical reaction which takes place is indicated by the following :—

$C_3H_5(O.C_{18}H_{35}O)_3 + 3\ NaOH = C_3H_5(OH)_3 + 3\ C_{18}H_{35}NaO_2$
(Tri-stearin + Soda = Glycerin + Sodium Stearate).
$C_3H_5(O.C_{16}H_{31}O)_3 + 3\ NaOH = C_3H_5(OH)_3 + 3\ C_{16}H_{31}NaO_2$
(Tri-palmitin + Soda = Glycerin + Sodium Palmitate).
$C_3H_5(O.C_{18}H_{33}O)_3 + 3NaOH = C_3H_5(OH)_3 + 3\ C_{18}H_{33}NaO_2$
(Tri-olein + Soda = Glycerin + Sodium Oleate).

The soap thus produced is salted out with salt, and the glycerin formed is recovered as much as possible from the spent liquor. It is essential to ensure that the fats have been thoroughly saponified, as also that no marked excess of alkali is introduced. The next step is to clarify the soap by boiling with a fresh supply of water from any insoluble soaps, *e.g.*, Lime and Magnesium Salts of the acids indicated above. The "nigre" containing these impurities subsides in this manner to the bottom of the vessel. The soap is then allowed to slowly cool and "settle." When cooled to 165° F. it is removed to the frames to solidify. Here it remains for a month to consolidate, and drain through apertures in the sides of the containing vessel.

For **Household Purposes** this soap is then cut up with wires into bar form and stamped.

For **Toilet Purposes** special soap bases are employed containing a large proportion of Stearates (obtained from 'edible' animal fats—tallow). It is obvious that the fats must not be rancid or of strong colour. A high acidity and unpleasant odour would render the fat quite inadmissible. A proportion of palm oil is generally combined with the tallow.

The soap ultimately is converted by special machinery into ribbon-shaped shreds, it is perfumed and after other treatment is finally stamped in moulds—*vide* last edition for further details.

For **Shaving Soap** it is necessary to employ fats—'strong' tallow—with a high melting point.

Ordinary Household Soaps are made with vegetable oils of light gravity.

Good average soap can be produced by saponifying vegetable oils, such as those of Cottonseed, Palm, or Cocoanut (of this the best variety is known as "White Cochin" Oil, the second as "Ceylon" Oil); but these oils containing a large proportion of the Oleic Ester produce more soluble *i.e.* wasteful soaps.

The use of **resin** in household soap is not at all injurious; on the contrary resin soap is very soluble and lathers freely. The addition of the resin renders the soap smooth and prevents efflorescence. Further, the cleansing 'odour' imparted by the resin is liked by many. It is not, however, suitable for toilet purposes, and a large admixture cannot be allowed. Occasional additions to common soaps are chlorophyll, sodium silicate and French chalk.

**Transparent Soaps** are made by setting from methylated spirit. Many contain resin and sugar (as much as 20% of each).

In Germany manufacturers have the privilege of using pure spirit with 1 kilo of Castor Oil and 400 Cc. of Soda Solution per 100 litres of Spirit to 'denature.'—C.D. ii./o6,718. It is stated that in the manufacture of transparent soap with methylated spirit only about ½ the spirit is recovered—the rest is lost in drying

### GERMICIDAL AND INSECTICIDAL VALUES OF DIFFERENT SOAPS.

Cocoa Nut Oil Soap is stated to have the highest germidical power. Castor Oil and Olive Oil Soaps were the only ones having germicidal action in 5% solutions,—the others (using various other Oils) scarcely had inhibiting action on *B. Typhosus* in broth. The combination of soap with an active agent does not invariably increase the germicidal value of the latter. The soap exerts a distinct influence on the value of Cresylic Acid. The insecticidal values showed no particular difference between the Potash Soaps of the different glycerides, — 1% being effectual in all cases except soap made with Rape Seed Oil.—B.J. ii./1,4199.

## Saponification Equivalents of Fats and Oils.

The *Saponification Number* or Köttstorfer's Number is the number of milligrammes of Caustic Potash which the fatty acids contained in 1 Gm. of the fat (free from moisture) are capable of neutralising. To 1·5 to 2·0 Gm. of the purified and filtered specimen for examination contained in an Erlenmeyer flask of about 200 Cc. capacity add 25 Cc. of N/2 Alcoholic Caustic Potash. Warm half an hour on water-bath with reflux condenser, with occasional rotation, add a little phenolphthalein solution and titrate excess of alkali with N/2 Hydrochloric Acid. Conduct a control using the alkali alone.

The difference in the number of Cc. of N/2 Hydrochloric Acid required to neutralise in the control and the actual test is easily converted into the number of Mgr. of KOH consumed by the amount of the fat or oil originally taken, and the result is expressed in equivalent of 1 Gm. of the specimen.

### Some Saponification Numbers:—

Adeps 195—203.
Adeps Lanæ 90—102.
Oleum Adipis (U.S.) 195—197.
Oleum Amygdalæ 191—200
Oleum Gossypii Seminis. 191—196.
Oleum Lini 187—195.
Oleum Morrhuæ 175—185.
Oleum Olivæ 191—195.
Oleum Ricini 179—180.
Oleum Theobromatis 188—195
Oleum Tiglii 212—218.

Solution of Potash in Propyl Alcohol suggested to replace Potash in ordinary Alcohol —P.J. ii./11,9.

For Iodine Number of Fats, *see* p. 39.

## SCAMMONIÆ RESINA.

In the testing of Scammony Resin for complete solubility in ether the presence of water in the ether makes a considerable difference. A Soxhlet is not recommended. It is best to macerate 6 hours 3 to 4 Gm. of the resin finely powdered in 30—40 Cc. of ether in a short, wide-mouth flask. Filter off and weigh insoluble matter and give percentage on the dry resin. An authentic resin extracted from the root gave 71°/₀ insoluble in ether (?).—P.J. i./07,401.

Solubility in 0·720 Ether, Acid and Saponification Values, also tests for Colophony, Guaiacum, etc.—P.J.ii./08,365.

Saponification Values characteristic of both the resins—of *C. Scammonia* and *Ipomœa Orizabensis*— enables detection of the Mexican Scammony. In the case of the former the Saponification No. is in the neighbourhood of 238, and in that of the latter a little below 190. For quantities and method of work consult Am. Jl. Ph. Mar. '09, p. 105. *See* also P.J. i./12,285.

A spurious sample made of brown industrial resin admixed with fine powdered Scammony Resin.—C.D. ii./11,897.

*C.R.* 1911. recommended that Resin from *Convolvulus Scammonia* and *Ipomoea Orizabensis*, Lebanois be both *Off.* Scammony Resin to be a mixture of resins from Scammony root *or* from Orizaba Jalap root, entirely soluble in Alcohol (90°₀). Perfectly dry Ether dissolves from 55–70% of it. Acid value should not exceed 25 ; Saponification value should range from 180–240. Tests are given for absence of certain foreign resins, especially Colophony.

## SODIUM.

An electrified gas from *Sodium*, according to C.E.S. Philips, exists which discharges a —charged electroscope : not so much when + charged. This is *not* due to rapid oxidation of the surface of the Sodium. Na, May 28, '08, 79 ; June 11, '08, 127.

### Bismuth-Cæsium-Potassium Nitrite.

Dissolve 50 Gm. of Potassium Nitrite in 100 Cc. of Water, neutralise with Nitric Acid and add 10 grams of powdered Bismuth Nitrate, then add sufficiency of 10% solution of Cæsium Nitrate to precipitate the Sodium present in the Potassium Nitrate --filter and add Cæsium Nitrate to a total of 2·5 grams.

Is a reagent by means of which small amounts of Sodium may be detected and estimated in presence of large quantities of potassium, the corresponding Sodium Salt $5\,Bi(NO_2)_3.9Cs.NO_2.6NaNO_2$ being almost insoluble.—Nature, Feb. 24, 1900, p. 498.

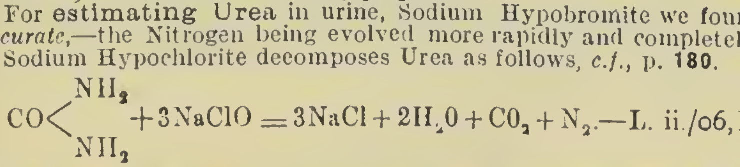
**Liquor Sodæ Chlorinatæ** (*Off.*). *Syn.* **Eau de Javelle.** 2·5% Cl. U.S. 2·4%. *Dose.*—10 to 20 minims (*Off.*). Dissolve Sodium Carbonate 600, in Water 1,000. Triturate Chlorinated Lime 400, with Water 3,000. Mix and filter. (*Off.*). U S. employs Monohydrated Sodium Carbonate 65, Chlorinated Lime 90, Water to 1,000. Process slightly modified.

Other Pharmacopœias use more Sodium Carbonate—it is suggested to increase it in the *Off.* article by one third, to obtain a preparation which will keep better.—B.C.D. i/09,178.

*C.R.* 1911.—" Should be freshly prepared."

For estimating Urea in urine, Sodium Hypobromite we found is *more accurate*,—the Nitrogen being evolved more rapidly and completely.

Sodium Hypochlorite decomposes Urea as follows, *c.f.*, p. 180.



$$CO\begin{matrix}NH_2\\NH_2\end{matrix} + 3NaClO = 3NaCl + 2H_2O + CO_2 + N_2$$

—L. ii./06,1143.

No water has been found which cannot be sterilised by 2 parts of Chlorine per million. 25,000 gallons can be sterilised for 1d.—Thresh, L. ii./08,1597,1846.

Nesfield found 0·125 Gm. Chlorine per litre (125 per million) of water teeming with *B. typhosus*, *B. Coli*, etc., sufficient to sterilise it in 5 minutes. Description of principle of **Nesfield's Sterilising Tablets.**—L. ii./08, 1708. One of Chlorine in 1,000,000 of Water acting 15 minutes will kill cholera vibrio in it :—L. ii/10, 1213.

**Sodium, Ammonium and Potassium Persulphates,** are strong bleaching agents, the latter $K_2S_2O_8$=268·34 (270.34 I, Wts.), known as **Anthion,** and the Ammonium Salt are used in Photography to reduce dense negatives—they oxidise and then dissolve part of the silver

On adding Barium Chloride to a Solution of Potassium Persulphate there is no precipitation. But on warming Barium Sulphate is thrown down.

The Ammonium Salt $(NH_4)_2S_2O_8$=226.56 (228.224 I. Wts.) is prepared by electrolysis of a solution of ammonium sulphate containing sulphuric acid. In presence of water it yields ozonized oxygen. **To sterilise sponges.** It has been used as a hand disinfectant. It bleaches.

For details of the therapeutic use of the Sodium Salt, see *Vol. I*

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## Spiritus Ætheris Nitrosi, *see* Ætheris Nitrosi Spiritus.

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## STROPHANTHUS.

Experiments on removing fat from, by cooling to 14° C, and by other methods. Cooling satisfactory.—P.J. ii./99, 469.

It has been stated that the fat in Strophanthus Tincture gives it an emetic action. Experiments on animals in America show this to be unfounded,—the fat being void of action. On the other hand, a dose of fat-free tincture injected *subcutaneously* produced prompt emesis.

In making the tincture it is important to employ *slow* extraction (by 65% Alcohol) in a long narrow percolator. A lower percentage Alcohol extracts the active principle more rapidly, producing an unsightly tincture which may be cleared by chilling and filtering in the cold. Defatting the seeds aids percolation but does not affect the strength of the tincture. When making in small quantities percolate at least 7 days with 1000 Cc. of Menstruum for each 100 Gm. of seeds. In addition there should be several periods of exhaustion of at least 8 hours each. Suggested min. lethal dose of the tincture $\frac{1}{30}$ to $\frac{1}{35}$ Cc per kilo of cat, injected subcutaneously (*i.e.*, about 40 cat units per Cc.). The seeds should be standardised to start with, *i.e.*, of the strength indicated by about 400 cat units per Gm. of seed.—Am. Jl. Ph., May, '09, 209.

STROPHANTHUS SEEDS. THEIR ASSAY BY CHEMICAL METHODS.

The powdered seeds (20 Gm.) are freed from oil by percolation with Petroleum Ether or Ethyl Ether,—they are then exhausted with Alcohol 70%. This tincture is evaporated to a soft extract at a low temperature, dissolved in 100 Cc. of Water, filtered in a separator, 3.2 Cc. of Sulphuric Acid (25%) added, then shaken out thrice with 20 Cc. Ether. The aqueous acid solution is warmed in a water bath for one hour at not exceeding 75° C. This decomposes the Strophanthin present into Strophanthidin and Strophanthobiose Methyl Ether. It is then cooled and shaken out in a separator with 10 Cc. of Chloroform,—Strophanthidin being soluble in this reagent. This is evaporated to a low bulk in a tared dish, allowed to crystallise out and dried at below 65° C. The result divided by the factor 0.365 gives amount of Strophanthin present. Various samples of the seed by this method gave 3.1 to 4.57% Strophanthin. It is suggested that the method would be suitable for the B.P. for assay of Tincture of Strophanthus. A standard of 0.1% w/v Strophanthin is advised. A chemical method is probably as useful as the physiological test.—J. Haycock, P.J. i./11, 553 ; B.C.D. i./11, 94.

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## THALLIUM.

Tl=204 (I. Wts.)

This element, resembling lead on the one hand and Potassium on the other, was discovered by Crookes by spectral analysis in residues of sulphuric acid manufacture.

Thallium Acetate Tl $C_2H_3O_2$=263.024 (I. Wts.). *Dose.*—1½ to 3 grains (0 1 to 0·2 Gm.)was tried in syphilis, but is not equal to mercurials; if given an hour before the commencement of a sweat, was found of value in the night sweats of phthisis. Loss of hair and arrest of perspiration accompany its use.

***Poisoning by Thallium Acetate.***—A workman drank a small quantity—less than 1 Gm. in solution in a Vichy bottle. Caused vomiting, acute sense of internal chill, cyanosis, lowered temperature, pain in the kidneys and reduction in urine voided. Abundant drinks were ordered, and baths. Symptoms disappeared in a few days. Loss of hair and arrest of perspiration were *not* seen.—L. i./II,1461.

# SYNTHETIC NOTES.

## Physiological effect in comparison with Chemical constitution of Drugs.

There are various **theories of the action of Poisons** on Cells. That of *Ehrlich*, in which he imagines that the poison becomes attached to the tissues by various chains or anchors before the poisoning can take place, is well known. The theory maintains that when these chains or groups become somewhat altered the union takes place with another cell structure, hence causing a different result.

The theory of *Loew* holds that substances which *can act on Aldehyde or Amino-groups* must be poisons to living tissues—they will act by substitution. According to him the greater the reactivity the greater the physiological result, *e.g.*, **Phenylhydrazine** and **Hydroxylamine** are very reactive to Ketone and Aldehyde groups,—hence poisonous both to plants and animals. *Anilin* is less reactive to Aldehydes than Phenylhydrazine and is less poisonous than the latter. If the chemical properties of a poison are *made more labile* by a change in the character of the molecule, then it becomes *more toxic* and *vice versa*, *e.g.*, if the Hydrogen of the NH group in many alkaloids be replaced by an Alkyl group the toxicity is diminished as the substance reacts less readily with Aldehydes. Similarly Piperidine is more toxic than Pyridine, Tetra-hydroquinoline is far more toxic than Quinoline by reason of the fact that the reduced Compounds which contain secondary Nitrogen in place of tertiary have a greater reactivity with protoplasm. Compare also Pyrogallol (Trihydroxybenzene) which is more poisonous than Dihydroxybenzene (Catechol) and Phenol. The toxicity of Phenols is in the light of this theory attributed to their reactivity,—especially with Aldehydes. *Salicylic Acid* (introduction of COOH) *is less reactive* with Aldehydes than Phenol, hence less toxic. **Loew's Theory** *only applies to certain bodies reacting with Aldehyde and Amino groups*, it does not explain selective action. Every tissue contains labile Aldehyde and Amino groups,—hence should react with a drug.

Reverting to **Ehrlich's Theory**,—in the example of **Morphine** it is thought that one of the anchors may be one of the OH groups. If these are combined with $H_2SO_4$ (forming Morphine-

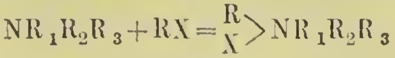
Sulphuric Acid) the substance cannot attach itself to nerve tissue hence Morphine-Sulphuric Acid has no hypnotic effect. The *entrance of an organic radicle*—Methyl, Ethyl, Acetyl causes the *hypnotic power to be reduced* whilst action on the *respiratory* centres (produced by Morphine to a slight extent) is much *increased*, *e.g.* in the case of **Codeine** and **Diacetyl Morphine.**

The relationship between **Arecoline** (the **Methyl Ester** of **Arecaidine**) and **Arecaidine** exemplifies the fact that in cases **where the presence of an Acid group** prevents the substance from acting physiologically in spite of the presence of an anchoring group, the *conversion of the acid into an Ester* causes the physiological action to appear. The Methyl group in this case does not cause the marked difference,—the effect resides in the Arecaidine which is prevented from showing itself by the Acid group present,—*c.f.*, also **Benzoyl-Ecgonine** and its **Methyl Ester** which is **Cocaine.** Note that analogous effects can be brought about by Ethyl as by the Methyl group. When the Carboxyl group in the molecule is masked we get anæsthetic effect.

With regard to the question of **physiological action depending on chemical change of the substances while passing through the organism**, a few observations may be offered between some osely related compounds. Wide generalisations cannot be made in these questions,—a case to illustrate this is the decomposition of **Xanthine, Theobromine** and **Caffeine,** the first being without action on the heart muscle, the second acting slightly and the third showing more marked toxic action. It was found that the products of metabolism after giving Caffeine and Theobromine contain Xanthine bases poorer in Methyl groups than the substances given,—the Methyl groups had been split off. In man Caffeine is reduced to Theophylline,—this shows that there is a *splitting off of Methyl groups* which groups appear to be responsible for action on the heart, *i.e.*, there is a relationship between physiological action and the changes undergone by the substance in the organism. It is, therefore, often useful in devising new Synthetic Drugs to determine the substances that are formed in the organism when an unsuitable substance is administered. **Anilin,** for example, is eliminated as **Para-amino-phenol,**—this led to the introduction of a number of derivatives of this substance of which *Phenacetin* is the best known example, *c.f.*, " Coal Tar Derivatives" Chapter, *Vol I*,, p. 281. We shall revert to the question of alterations that take place in drugs passing through the system later.

With regard to the **Alkaloids** in general,—these seem to pass through for the most part *unaltered* and their action is in most cases difficult to explain. It is clear that if a substance is easily acted upon it will react *with all tissues* and hence produce no specific effect. (**Hydrocyanic Acid** can only be given in small doses for this reason.)

Whilst mentioning Alkaloids we should add the classic discovery of Crum Brown and Fraser. They showed that various Alkaloids possessing the most diverse physiological actions on combination with Alkyl halides to form quaternary Ammonium derivatives



$$NR_1R_2R_3 + RX = \genfrac{}{}{0pt}{}{R}{X}\!>NR_1R_2R_3$$

where $R_1R_2R_3$ are Organic Radicles of any complexity and RX stands for Alkyl halide, Methyl or Ethyl Iodide, etc., yield substances in almost every case possessing the property of paralyzing the motor-nerve endings in the same way as Curare. One can obtain therefore by *Methylation* from all tertiary bases, **quaternary Ammonium Compounds** which are *poisonous* compared with the original bases. Curare itself contains the tertiary base Curine which is not very poisonous, as well as the far more poisonous Ammonium base Curarine. *Curine on methylation yields Curarine which is 226 times as poisonous as the original substance.*

The fact that the action of **Inorganic Salts** injected into the blood depends on the *electro-positive* half is analogous with the action of most **Esters** which generally resembles that of the Alcohol concerned—in both cases the Acids are usually physiologically inert.

**Isomorphous Substances** in a group have similar action, *e.g.*, Li, Na, Rb, Cs, Ag, Tl, and the physiological intensity usually increases proportionally to the Atomic Weight. Potassium and Ammonium are exceptions. In **negative elements** *e.g.*, the **halogens,** there is no relation between physiological effect and atomic weights.

**Ionisation** plays an important part in the action of substances, *c.f.*, $HgCl_2$ which is ionised in solution and extremely poisonous and $Hg(CN)_2$ which is non-ionised (though soluble) and far less poisonous, *c.f.*, also $HgCl_2$ and $HgCl$.

**Schmiedeberg's Rules** regarding action of Aliphatic Compounds.

The action of these depends on *volatility and solubility*, *c.f.*, the *lower* with the **higher** members of the series of **Paraffins.**

(1). Poisonous radicles on substitution by simple Alkyl groups lose in intensity, *e.g.*, **Arsenious Oxide,** $O{=}As{-}O{-}As{=}O$ and **Cacodyl Oxide** $(CH_3)_2As{-}O{-}As(CH_3)_2$.

(2). The effect of the Alkyl groups can on the other hand be lost or lessened by combining with other atoms or groups, *e.g.*, the Mono-Di-and Tri-methylamine behave like Ammonia and have no narcotic action, but the first rule holds here also as these Amines are less toxic than Ammonia.

(3). The action of a body made by *uniting two groups by an Oxygen atom depends on the two components* each acting separately. Where the two groups are similar or equivalent alkyl groups, *e.g.*, in the **Simple and Compound Ethers** then the action of the whole is simple and the resulting body resembles in action the corresponding Alcohol. Analogous are the **Esters,** the acids of which yield neutral (Sodium) Salts without any specific physiological action. Acetic Ester and its homologues are therefore classed with the Alcohols. If the Acid however has a specific action of its own then this shows itself in the Ester and has a modifying effect on the action of the Alkyl group,—*e.g.*, Amyl Nitrite.

The Hydrocarbons of the Methane series are less active than the *Ethylene, Acetylene or Benzene Series.* In the Methane Series commencing with the lower members we have the *anaesthetic* and *narcotic action*—this decreasing with loss of volatility and solubility In the Ethylene series there is also evidence of narcotic action, *e.g.*, Amylene. The Benzene Hydrocarbons show *paralyzing action on motor nerves* and further action on the *brain and spinal cord.*

**Effects of Alkyl Groups,**—in addition to those provided under Schmiedeberg's rules, P. May mentions a number of others. Methyl groups introduced into Ammonia produces Tri-methylamine which is free from convulsive effects, *c.f.*, also the effect of introducing Methyl groups into the Amino group in Anilin, but if the Hydrogen of the nucleus be replaced by Methyl groups there is an increase in the effects, *c.f.*, also the methylation of Xanthine (*antea*). *Replacement of the Hydrogen* of an Hydroxyl group often reduces activity, *c.f.*, Catechol $C_6H_4(OH)_2(1:2)$. Guaiacol $C_6H_4OH.OCH_3$ and Veratrole $C_6H_4(OCH_3)_2$. Again *Ortho*-methoxybenzoic Acid $C_6H_4OCH_3COOH$ and Anisic Acid $CH_3O.C_6H_4.COOH$ are less active than Salicylic Acid $C_6H_4OH.COOH$ but this is not invariably true—Resorcin $C_6H_4(OH)_2(1:3)$ is far less poisonous than Dimethyl-resorcin $C_6H_4(OCH_3)_2$ (1 : 3).

**Ethyl groupings** have a marked influence in causing action on the *central nervous system*, more so than Methyl groups. Another interesting difference between Ethyl and Methyl groups is seen in the case of *para*-phenetol-carbamide $C_2H_5O.C_6H_4.NH.CO NH_2$ (Dulcin) which is intensely sweet and the *Methyl analogue* which is *tasteless.*

**Effect of Phenyl Group,**—no general rule.

**Effect of Hydroxyl Group.**—In *aliphatic bodies* the Hydroxyl group usually weakens action and it is roughly proportional to the number of OH groupings introduced, *c.f.*, conversion of the narcotic Alcohols into Glycols, Glycerol, Mannitol, etc.

The effect is otherwise however in the case of the *aromatic bodies*—the OH usually *increases* effect,—*c.f.*, the obvious case of Benzol and Phenol also Benzoic and Salicylic Acids. The OH very often performs the function of an anchoring group, *e.g.*, for esterification.

Primary Alcohols as a generalisation are less active than secondary and these again less active than the tertiary.

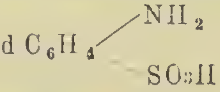
**Effect of Halogen.**—

In aliphatic bodies there is *increase in narcotic power*, but there is *also an increase in depressant action* on the heart and blood vessels. The narcotic power and toxicity of Chlorine compounds is well seen in the case of the Chlorhydrins,—narcotics and vasodilators derived from Glycerin which is inert, Tri-chlorhydrin being most active and the Mono-compound least. Note that in the case of the Trichlor- and Monochloracetic Acid the toxicity is reversed. Halogen introduced in the Benzene nucleus causes little alteration in properties. Organic Iodine Compounds differ from those of Chlorine and Bromine in having greater antiseptic and toxic properties and diminished hypnotic effects.

**Effect of Nitro- and Nitroso- Groups.**

Either of these whether replacing Hydrogen in the nucleus or in an Hydroxyl Group causes *increased toxicity.* The Aliphatic Nitrites are vasodilators, *c.f.*, Amyl Nitrite. All the Nitrites act in this way, the secondary and tertiary being stronger than the primary, probably owing to the fact that they are more readily hydrolised to Alcohol and Nitrite. Nitroglycerin and Erythrol Nitrate,—Esters of Nitric Acid show similar action. In the *Aromatic Series* a Nitro Group entering also usually *increases toxicity.*

**Effect of Basic Nitrogen Groups.**—This can produce in either series important changes to which P. May makes various references. The introduction of *Alkyl groupings* into such bodies reduces toxicity and as before gives *hypnotic effect*, *e.g.*, Carbamic Acid $NH_2COOH$ (poisonous) gives Urethane Ethyl Carbamate—more stable and hypnotic. Hydrazine $NH_2—NH_2$ is far more toxic than $NH_3$. but the Tetra- and Penta- Methylene derivatives are non-toxic.

The entry of the Amino Group into the Benzene nucleus forms the groundwork of a large number of antipyretics and analgesics. Anilin like Ammonia produces cramps, but like Benzene it also causes paralysis of muscles and nerves and if one of the Hydrogen atoms of the $NH_2$ group be replaced by Alkyl the cramps disappear and the paralysing action remains. If an Hydrogen atom in the nucleus be replaced by a single atom, *e.g.*, Bromine, the cramp effect is retained, and if it is replaced by an alkyl group the effect is increased, but if a complex group, especially an acid group, *e.g.*, $SO_3H$, enters the nucleus, the effect is lost, *e.g.*, in Amino Benzene—Sulphonic Acid  $C_6H_4{<}^{NH_2}_{SO_3H}$. As a rule aromatic derivatives of $NH_3$ *lower temperature.*

**Effect of the CN radicle.**—Isocyanides (Isonitriles) cause paralysis of the respiratory centre and the Cyanides (Nitriles) produce coma. Neither, however, are as poisonous as HCN. The lower members in the fatty series, $CH_3CN$ and $C_2H_5CN$ are less poisonous than the higher—Cyanacetic Acid $CNCH_2COOH$ is practically non-toxic. Cyanogen Chloride CNCl on the other hand is very toxic as it yields readily HCN.

**Effect of Aldehyde Groups.**—

Formaldehyde is very reactive chemically and therefore physiologically. It is a strong irritant on the mucous membrane. Acetaldehyde produces excitation, and then anaesthesia. Paraldohyde is stronger in action than the latter. *By entry of OH* into the Aldehyde molecule and by condensation of these bodies to form Aldols, *reactivity is lowered*, as also physiological power,—the sugars are practically inert. The aromatic Aldehydes are of low toxicity.

**Effect of Ketones**—Similar to that of Alcohols,—narcotic. An hypnotic action is seen in the Mixed Ketones, *e.g.*, Acetophenone $C_6H_5—CO\text{-}CH_3$

**Effect of Acid Groups.** These cause generally a *decrease in activity* or total suppression *e.g.*, substances containing an OH group on combining with *Sulphuric Acid* lose their toxicity—Phenol → Phenyl Sulphuric Acid as Sodium Salt $C_6H_5O.SO_2.ONa$ is harmless, *c.f.*, also Morphine $C_{17}H_{17}NO\ (OH)_2$,—Morphine-Sulphuric Acid $C_{17}H_{17}NO(OH).O\ SO_2.OH$—this latter, as already referred to, is practically inert. The Sulphonic Acids of various drugs are in nearly every case of little use, the introduction of *Carboxyl* (COOH) is almost analogous. COOH for example reduces toxicity of Benzol which can be taken in doses of 8 Gm. per day to 12 to 16 Gm. of Benzoic Acid. Methylamine $NH_2CH_3$ is toxic. $NH_2CH_2.COOH$ (Glycine) is harmless. The mere *addition of Acid radicles* without converting the body into an Acid may suffice, *c.f.*. $NH_3$ poisonous, $NH_2CO—CH_3$ Acetamide practically harmless. Acetanilide is less poisonous than Anilin.

The addition of Acid radicles to active bases is useful in synthesis of drugs,—especially with regard to acetylation of the $NH_2$ group,—to weaken basicity and *retard action*. Acetyl, Lactyl, Benzoyl and Salicyl groupings are used, but the *Acetyl* has advantages over the others.

(J. Grier—P.J. ii./11,533 remarks practically all *synthetic antipyretic* and *analgesic* drugs contain the *acetyl radicle*. Not only so, but it occurs in such naturally occurring pain-relieving drug-principles as aconitine and colchicine.)

**Unsaturated Links.** Unsaturated substances are usually more toxic than the saturated. Allyl Alcohol $CH_2{=}CH.CH_2OH$ is strongly poisonous, but is not narcotic. **Propyl Alcohol** $CH_3CH_2CH_2OH$ is narcotic, but not really poisonous. This relative toxic action is a general property of unsaturated as compared with the corresponding saturated bodies.

**Molecular Weight, Isomerism, etc.**—

Increase in Molecular Weight in homologous series generally produces *increased toxicity*. Several instances in which stereo isomerides differ are given, *e.g.*, Isopilocarpine and Pilocarpine, Maleic and Fumaric Acids, Atropine and Laevo-Hyoscyamine, Dextro and Laevo-Nicotine and the natural Adrenalin which is about 11 to 12 times as active as the Dextro compound. With regard to *ortho-*, *meta-* and *para-* Benzene derivatives, no generalisations can be made. *Para-* compounds are often more poisonous than the *ortho*.

With regard to **changes that take place on passing of an organic drug through the system** already referred to, the following is of interest,—*Salts of Organic Acids are generally decomposed into the free acid and a Chloride of the base*, but *Esters* and similar bodies are in the majority of cases *undecomposed* by the *gastric* contents. In the small intestine, however, the drug encounters the pancreatic enzyme trypsin and an alkaline medium. Trypsin has marked hydrolizing action on Esters, Anilides and similar bodies,—*here after saponification the components of the drug exert their specific action.*—The generally accepted decomposition of Acetyl-Salicylic Acid in the intestine is here pointed out, to which we have devoted some attention, *vide* Conclusions, *Vol. I.* p. 70, *et seq.*

Aliphatic bodies suffer usually complete oxidation to Carbon Dioxide, Water and Urea, Aromatic bodies on the other hand maintain the nucleus, the decomposition being concentrated on the side chains.

From the "Chemistry of Synthetic Drugs," by Percy May, B.Sc., (Longmans Green and Co., 1911). By permission of the author.

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## PHYSIOLOGICAL STANDARDISATION.

This method of testing is employed in those instances in which the drug contains no definite crystalline, easily isolated, active principle, *e.g.*, an alkaloid capable of extraction.

It consists in "determination of the change in function induced in living organisms by the administration in the state of minute division of such inorganised substances as do not act merely as foods, for the purpose of identifying and adjusting the strength of drugs; this may be either qualitative or quantitative."

The physiological action of a drug is the affinity it possesses for certain constituents of the protoplasm of the cells of particular organs of the body. Thus Ergot has a specific action on the uterus. Cocaine has affinity for nerve endings, and Strychnine acts similarly on the protoplasm of the spinal cord. Furthermore, as a result of the elective principle, drugs, according to their specific action on the organs, are designated stimulant, depressant, or irritant. The animals used for physiological determination should obviously be of the same species and weight, and should have been grown and kept under similar conditions. It is often useful to divide the small animals (*e.g.*, frogs) into classes according to weight, and use these in 'batches' for experimental investigations. Much comparative work has been done with various heart tonics, *e.g.*, Digitalis and Strophanthus (1) by direct application of a solution to the laid-bare frog's heart, and (2) injection intravenously or subcutaneously into dogs, rabbits, &c.

The quantitative test is based on the fact that the killing power of heart tonics for 'similar' frogs is constant per unit of body weight. Comparisons are made between effects produced by the sample preparation under examination and a standard preparation, *e.g.*, a tincture made from genuine Kombé Strophanthus.

In the matter of **Ergot Preparations**, when these are given in suitable doses to cocks they produce a blackening of the comb—the blackening being proportional to the quantity of the drug administered and the rapidity of absorption. Reliable comparative results are said to be procurable on these lines by using a standard preparation against the one to be tested (but we question the valency of the comparison of this action with that on the uterus of a pregnant woman.)

**Suprarenal Glands and Adrenalin.**—Standardisation of these has been effected against a standard freshly made 1 in 1,000 Adrenalin Solution Adrenalin produces a transitory rise in blood pressure, and the rise is proportional to the amount of actual Adrenalin injected. For outline of technique

*Vide* also "Notes on Physiological Testing," by A. C. Crawford, Am. Jl. Ph., July, '08 321; *ibid.* Mar., 1910,101; Aug., 1910,360. See N.S.D., 1906, 1732. *See also Vol. I. of this work for all the above preparations in particular the chapter on Digitalis Folia Vol I., p. 338, et seq.*

## 'PATENT' OR PROPRIETARY MEDICINES.

In the following list we provide the approximate composition of 'Patent' Medicines—several are mentioned incidentally in the text. The '*British Medical Journal*,' the '*Lancet*,' etc., from time to time have published results of analyses, and reference to their pages is made below in each instance. Considerations of space have usually obliged us to mention only the ingredients which have undoubted therapeutic effect. The reader is referred to the original sources for further details. With regard to the great majority of medicines, it should be noted that there are other ingredients which, though for the most part flavourings or colourings, may in some cases be considered to be medicinal. Our list must not be considered complete, though care has been exercised to state therein what appear to be the chief ingredients. The composition of some 'Patent' Medicine' may be found to vary from time to time. Again the composition of a proprietary article in one country does not necessarily convey a correct impression of articles sold under the same name in other countries.—B.M.J. i./10,339.

The majority of those 'Patents' to which we give B.M J. references are described in 'Secret Remedies, what they cost and what they contain,' a work issued by the British Medical Association, to which we would refer our readers. In some instances we give this work as our only reference.

More or less effective control over the sale of Proprietary Preparations exists in America, France, Italy, Portugal, Russia, and other countries, and in these countries as well as in Austria, Belgium, Brazil, Holland, Hungary, Norway and Sweden the practice of medicine and of the treatment of diseases and injuries of the body by unqualified persons is forbidden.

Regarding German legislature *vide* B.M.J. i./08,960. *c.f.* also 'Lancet, i./08,1086.—A £500 licence was advocated.

It appears that barefaced and ignorant quackery is rampant in Germany owing to the repeal of old laws which prohibited the practice of medicine by others than educated practitioners.—B.M.J. ii./08,170. Education necessary *c.f.* P.J. ii./09,323. Questions in Parliament.—B.M.J. ii./09,721,813,905,1707.

"The Government reaps a very rich harvest from secret preparations and remedies or nostrums. They have a government stamp on them, and the Treasury gets many thousands a year out of them,—wrongly, I think. The Government does not think so, however."—Coroner Dr. F. J. Waldo.—P.J. ii./09,303.

Campaign against proprietaries in Austria. Plan suggested was that they should be advertised only in medical periodicals and that labels and containers bear name of article and name of manufacturer only without reference to disease.—P.J. ii./08,686.

Desirability of enforcing the labelling of Proprietary Medicines and Foods, with a full statement of contents as required by the Pure Food and Drugs Act in America.—'State Regulation of Proprietary Medicines and Foods.'—B.M.J. ii./08,574.

Dixon on Proprietary Patent and Secret Remedies. *See* P.R.S.M., Therap and Pharmacol. Sect., Mar. 1910, p. 82.

In B.M.J. of May 27th, 1911, papers on 'Cancer Credulity and Quackery (see also Cancer Chapter), 'Bone-setting,' 'Quackery and Female Complaints' 'Skin Diseases and Cosmetics,' 'Unqualified Practice,' 'Quackery in Rural Districts,' 'Quackery in the Past,' 'Herbalists and Medical Practice,' 'Unqualified Practice in the Eye of he Law,' 'Unqualified Practice through the Post,' 'Quackery in Aural Diseases,' 'Quackery in France,' 'Causes of Quackery,' etc., will be found.

The opinion is expressed that the QUACKERY PREVENTION ACT, 1908, of NEW ZEALAND might be imitated—any person commits an offence who publishes any statement intended to promote the sale of any article as a medicine for prevention or cure of any ailment or physical defect which is false in any material particular.—Gadd.—B.M.J. i./11,767.

The British Medical Association, the British Pharmaceutical Conference, and other Associations joined issue with the Parliamentary Committee on Food Reform to bring the whole subject before the Home Secretary, a Departmental Committee or a Royal Commission.—P.J. ii./11,69.

The Home Secretary has appointed a Select Committee to inquire into the conditions prevailing in the United Kingdom regarding sale of Patent and Proprietary Medicines. The Royal College of Physicians, London, made certain recommendations as to the exact composition of the contents of bottles, etc., being printed thereon, and that manufacturers shall not be allowed to print names of diseases or symptoms on same. *c.f.* C.D. July 1, 1911. We may point out that in certain countries legislation on these lines has been found inoperable.

The Committee met for the first time May 9th, 1912, and received evidence from the Board of Inland Revenue (per Sir N. Highmore) also on May 16th, 1912.—c.f. B.M.J. (May 18th), i./12,1140 ; C.D. May 18th, 1912.

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## LIST OF 'PATENTS' WITH REFERENCES.

★ **Abbey's Salt.**—*(Aperient) Tartaric Acid, Sodium Bicarbonate, Magnesium Sulphate and Sugar.—L. ii./03,1493.*

**Albukola.**—*A German speciality containing* 35 *parts of Saccharated Iron Carbonate,* 15 *parts Calcium Phosphate,* 25 *parts Arrowroot, Albumen and Lecithin, the Lecithin being about* 8%.*—B.M.J. ii./08,204.*

★**Alcola** (*inebriety*).—*Three kinds of Tablets.*

Ⓟ **No. 1 Tablets** *showed the presence of Strychnine* 0.12, *Caffeine* 4.72, *Sugar of Milk* 86.9, *Talc* 4.1 *per cent. with Starch, a little Gum or Dextrin and a trace of colouring matter. Each tablet would contain* 0.007 *grain Strychnine and* 0.26 *grain Caffeine.*

Ⓟ **No. 2 Tablets.**—*Strychnine* 0.2 (*approximately*), *Boric Acid* 4.4, *Sugar of Milk* 82.8, *Talc* 3.0 *per cent., Starch and colouring matter, also a trace of vegetable debris perhaps from some vegetable extract. Each Tablet would contain about* 0.011 *grain of Strychnine.* Ⓟ *If less than* 2% *strychnine.*

Ⓟ **No. 3 Tablets.**—*Analysis showed Tartar Emetic* 16.7, *Calcium Sulphate* 61.4, *Talc* 3.1 *per cent. with Starch and colouring matter. A trace of a pungent substance resembling pepper, and a trace of vegetable debris which may have been from some vegetable extract—were also present. Each Tablet would contain* 0.48 *grain Tartar Emetic.—B.M.J. i./12,143.*

★**Allen's Antifat.**—70 *minims liquid extract of Fucus in the ounce.—B.M.J. ii./07,209.*

★ **Antexema.**—*Soft Paraffin* 35·4, *Boric Acid* 1·5, *Gummy Matter* 12·4, *Water* 50·7.*—B.M.J. i./08,912.*

**Antidipso.**—*(Drink cure) Chlorate of Potash and Sugar.—L. ii./03,1493.*

*White Powders.—Potass. Brom.* 24·5, *Milk Sugar* 75·5%. *Coloured Powder.—Potass. Brom.* 35, *Milk Sugar* 65%.*—B.M.J. i./09,910.*

**Anti-fat.**—*See Allen's above.*

★**Antineurasthin.**—*Tablets would contain approximately Dry Yolk of Egg* 3·8, *Dry White of Egg* 5·4, *Dry Separated Milk* 57·8, *Gum* 2·0, *Potato Starch* 22·7, *Moisture* 8·3%, *Aromatic substances traces—B.M.J. i./09,544; see also P.J. i./08,644.*

★**Antipon.**—(*Obesity*) *contains* 39 *grains per ounce of Citric Acid.—B.M.J. ii./07,25.*

**Anturic Bath Salts.**—*Analysis showed the salt to consist of Sodium Carbonate (reckoned as Anhydrous)* 96 86%, *Water* 2·70%, *Chloride, Potassium salt, perfume, traces.—B.M.J. i./10,393.*

**Armbrecht's Coca Wine.**—*Alcohol* 15·05, *Glucose* 20·8, *Coca Alkaloids* 0·006%, *inter alia. Wineglassful represents about* 14 *minims of Liquid Extract of Coca.—B.M.J. i./09,1307.*

**Asandrin.**—*Perfumed Solution of Quinine Sulphate with Precipitated Sulphur.—L. ii./08,104.*

**Atkinson & Barker's Royal Infants' Preservative.**—*Analysis showed in* 100 *by measure,—Potassium Bicarbonate* 1·75, *Magnesium Carbonate* 5·45, *Essential Oil about* 0·06, *Alcohol* 7·0 *by measure, Sugar* 9·9, *colouring matter a trace.—B.M.J. i./12* 683.

**Automars.**—B.M.J. i./10,762.

**Baillie's Pills.**—(*Aperient and Liver Pills*) *Aloes, Colocynth, Oil of Cloves and Soap.—L. ii./03,1493.*

★**Balsam of Aniseed.**—*See* **Powell's.**

**Bandon's Wine.**—*Alcohol* 12·75%, *Glucose* 13·1, *Phosphorus calculated as Phosphoric Acid* 0·54, *Antimony minute trace.—B.M.J. i./09,1309.*

**Baring Gould's Antirheumatic Pearls.**—*Gelatin Perles or Capsules containing white powder, analysis of which showed Acetyl-Salicylic Acid* 85%, *Milk Sugar* 15%.—*B.M.J.* ii./08,1112.

★**Beecham's Pills.**—(*Aperient*) *Aloes, Ginger and Soap.*—*L.* ii./03,1493. *Quantities as follows were found:—Aloes* 0·5 *grain, Powdered Ginger* 0·55 *grain, Powdered Soap* 0·18 *grain in a pill.*—*B.M.J.* i./09 32.

**Beecham's Cough Pills.**—*In spite of the statement that these do not contain Opium results obtained pointed to the formula; Morphine* 0·0035 *grain, Powdered Squill* 0·1 *grain, Powdered Aniseed* 0·3 *grain, Ammoniacum* 0·3 *grain, Extract of Liquorice* 0·4 *grain.*—*B.M.J.* ii./08,1699. *According to this analysis these pills would be* Ⓟ.

**Bell's ★Fairy Cure.**—*Powders each containing Acetanilid and Phenacetin each* 1·16 *grains, Caffeine* 0·38 *grain.*—*B.M.J.* ii./06,23.

**Bendle's Meat Port Nutrient.**—*White Capsule Brand. Wineglassful* (2 *ounces*) *contains Alcohol* 3·25 *drachms, Meat Extract* 22 *grains, Glucose* 70 *grains.*—*B.M.J.* i./09.796.

★**Bengue's Balsam.**—*Analysis showed the composition to be:—*

*Menthol* 18, *Methyl Salicylate* 20, *Lanolin Anhydrous* 54 *and a fat, apparently Lard*, 8%.—*B.M.J.* ii./10,986.

★**Bile Beans Charles Forde's.**—*Average weight* 2·3 *grains. Examination showed Aloin, powdered Cardamoms, Oil of Peppermint, Wheat Flour and possibly presence of Colocynth.*—*B.M.J.* i./11,1326.

★**Birley's Anticatarrh.**—*Analysis showed presence of: Sugar* 74, *Tartaric Acid* 1·15, *Phosphoric Acid* 0·07, *Alcohol trace, Water to* 100. *No free phosphorus could be detected, but odor suggested a trace.*—*B.M.J.* ii./08,1286.

**Blair's Gout Pills.**—*Active ingredient is Colchicum.*—*L.* ii./03.1493. *Quantities found indicated Powdered Colchicum Corm.* 2·1 *grain, Burnt Alum* 0·35 *grain in one pill.*—*B.M.J.* ii./08.1110. Ⓟ *According to this Analysis.*

★**Bovril Wine.**—*According to analysis a wineglassful* (2 *ounces*) *would contain Alcohol* 3¼ *drachms, Meat Extract* 4·4 *grains, Glucose* 88·0 *grains.*—*B.M.J.* i./09.795.

**Bowden's Indian Balm.**—*A brownish yellow Ointment. The following resembled it,—Lard* 35, *Cocoa Nut Oil* 35, *Tallow* 10, *Rape Oil* 5, *Lanolin Anhydrous* 4·5, *Peru Balsam* 1, *Eucalyptus Oil* 5, *Terebene* 1·5, *Essential Oil of Camphor* 1·5, *Oil of Lemon* 0·5, *Solution of Ammonia* 1, *Annatto q.s.*—*B.M.J.* ii./11, 853.

Ⓟ**Bow's Liniment.**

★**Box's Pills** (*see also* **Golden Fire**).—*Average weight* 2½ *grains. The following formula gave a pill substantially agreeing in character with the pill under examination.—Powdered Capsicum* 35, *Powdered Gentian* 15, *Flour* 15, *Aloes* 20, *Soap* 5, *Water to* 100 *parts.*—*B.M.J.* ii./10,987.

Ⓟ★**Bromidia.**—(*Neuralgia*) *Potassium Bromide, Chloral, Hyoscyamus, Cannabis Indica, Aniseed Oil, Syrup and Water.*—*L.* ii./03,1493.

Ⓟ★**Brompton Consumption and Cough Specific.**—*The formula is approximately Liquid Extract of Ipecacuanha* 0·75, *Tincture of Opium* 1·3, *Treacle* 75, *Water to* 100.—*B.M.J.* ii./08,506.

**Blak Thyrol Female Pills.**—*Freed from coating the pills had an average weight of* 5.1 *grains. Contained sufficient Pennyroyal Oil to give them a distinct odor of it Reduced Iron* 14%, *Arsenic (calculated as Arsenious Acid)*, 0·06% *or about* 1/300 *grain in each (might be present as impurity), a trace of alkaloid, Powdered Ginger, Liquorice and another vegetable powder.*—*B.M.J.* ii./11,767.

**Blanchard's Apiol and Steel Pills.**—*Freed from coating the pills had an average weight of* 3.9 *grains. Analysis showed presence of Sulphate of Iron, Soap, Barbadoes Aloes, Powdered Ginger, Cardamom and Cinnamon, also a little Apiol.*—*B.M.J.* ii./11,36.

★**Brown's Bronchial Troches.**—*Chemical analysis and microscopical examination showed the presence of Powdered Cubebs (also possibly Extract) about* 6%, *Extract of Liquorice in small quantity, Gum and Sugar (about* 70%).—*B.M.J.* ii./11,1543.

★**Buer's Mul'la Piles Cure.**—*Ointment: Galls and Hamametis, with Lanolin basis. Powder: Precipitated Sulphur and Magnesium Carbonate.*—*L.* ii./03, 1493.—*Later report.*—*B.M.J.* ii./08,86.—*Anhydrous Lanolin* 66·5, *Beeswax* 1·5, *Water* 32·0%. *Powder.—Precipitated Sulphur* 14·9 *grains, Calcined Magnesia partly carbonated*), 23·6 *grains.*

✶**Bunter's Nervine.**—*Creosote, Chloroform, Camphor, Balsam of Tolu and Alcohol.—L. ii./03,*1493.

**Burgeaud's Wine.**—*Alcohol* 14·80%, *Glucose* 18·9%, *Alkaloids (Cinchona)* 0·01%. *A wineglassful represents about* 2 *minims of Liquid Extract of Cinchona.* —*B.M.J. i./09,*1303.

✶**Burgess' Lion Ointment.**—*The following is similar—Lead Plaster* 13, *Beeswax* 20, *Resin* 11, *Olive Oil* 12, *Water* 6, *Lard to* 100.—*B.M.J. ii./07,*393.

✶**Burgess' Lion Pills.**—*Average weight* 4½ *grains without coating. Examination indicated Ipecacuanha, Rhubarb, a little Jalap, probably Aloes (Socotrine), Oil of Peppermint and Soap.—B.M.J. i./11,*1327.

**Busennährcreme, Bauch's**, *consists of mineral Fat perfumed with Oil of Rose.—Deut. Med. Woch., Sept.* 15/10, *per B.M.J. ii./10,*1900.

**Busteria, Steiner's.**—*Consists of Bean and Pea Flour.—Deut. Med. Woch., Sept.* 15/10, *per B.M.J. ii./10,*1900.

✶**Bynin Emulsion of Cod Liver Oil with Hypophosphites.**—*Oil* 34·6%, *Reducing Sugars (as Maltose)* 9·0%, *Protein* 1·2%, *Hypophosphite in very small quantity.—B.M.J. i./10,*30.

✶**Bynol.**—*Oil* 12·9%, *Reducing Sugars (as Maltose)* 52·2%, *Protein* 4·6%, *Diastatic Power* 22.—*B.M.J. i./10,*30.

✶**Cadum.**—*Analysis showed Zinc Oxide* 11.3, *Flowers of Sulphur* 8.0, *Boric Acid* 3.1, *Salicylic Acid* 0.8, *Oil of Cade* 7, *Hard Paraffin* 10, *Soft Paraffin* 60%.—*B.M.J. ii./10,*1352.

✶**Californian Syrup of Figs**—*Senna (active constituent), Syrup of Figs and Cinnamon.—L. ii./03,*1493.

✶**Capsuloids.**—*Result of analysis indicated for the contents of the Capsules—Hæmoglobin* 1·97 *grains, Olive Oil and Oleic Acid of each* 0·54 *grains, Balsam of Peru and Purified Storax* 0·17 *grain in one Capsule.—B.M.J. i./08,*833.

**Cardigan Cancer Cures.**—*No authentic and unquestionable malignant growth known yielding to the cure.—B.M.J. i./11,*753.

**Carnabyn.**—*Alcohol* 17·2, *Total Solids* 13·4, *Nitrogen* 0·26, (*equivalent to Protein* 1·7), *Ash* 0·7, *Reducing Sugar (as Glucose)* 9·2%.—*B.M.J. ii./09,*562.

**Carnrick's Liquid Peptonoids.**—100 *parts contained Alcohol* 20, *Total Solids* 18·8, *Nitrogen* 0·8 (*equivalent to Protein* 5·0), *Ash* 0·8, *Reducing Sugar calculated as Glucose* 7·7, *Cane Sugar* 2·4.—*B.M.J. ii./09,*562.

(*Requires spirit license, but objection is not raised to its sale in small quantities by chemists when ordered by a medical man*), *c.f. also Vol.* I. *p.* 602.

✶**Carter's Little Liver Pills.**—*Podophyllin* ⅛ *gr. and Aloes Soc.* ⅓ *gr. in each pill.—L. ii./03,*1193.

*B.M.J. i./11,*1326 *gives—Freed from coating average weight of the pill is* ⅓ *grain, evidence of Aloes (Barbados) or a preparation of, Podophyllin, Powdered Liquorice Root and Wheat Starch was obtained.*

**Cassell's (Dr.) Blood Cleansing Tablets.**—*Weight about* 6 *grains each Analysis showed Phenolphthalein* 0.75, *Pot. Iodide* 1.25, *Sugar* 81, *Talc approx.* 11, *Calcium Carbonate and Sulphate approx.* 2, *Water* 1, *Extractive* 3%. *The dose of Phenolphthalein in one Tablet is* 0.045 *grain, and the dose of Potassium Iodide is* 0.075 *grain.—B.M.J. ii./10,*1352.

**Cassell's Dusting Powder.**—'*Antiseptic Dusting Powder No.* 2.' *Analysis showed Powdered Talc* 60, *Boric Acid* 20, *Maize Starch* 17, *Slippery Elm Bark* 3%.—*B.M.J. ii./10,*1352.

**Cassell's Ointment.**—'*Ointment No.* 2' *showed as closely as possible,—Boric Acid* 8, *Borax* 2, *Oil of Eucalyptus* 2, *Oil of Wintergreen* 3, *Anhydrous Lanolin* 4, *Oil (? Olive)* 8, *Soft Paraffin* 63, *Powdered Drug (? Krameria root)* 7 *Water* 3%.—*B.M.J. ii./10,*1352.

✶**C.B.Q. Post's Tablets** *we understand are exempt from Poisons' Schedule* 1908. *Analysis made in* 1908 *showed that each tablet contained* 1½ *grains of Potassium Iodide, a small quantity of Salicylate, a vegetable Extract and Magnesia, also a small quantity of Alkaloid which was not identified.—'Secret Remedies.'*

Ⓑ✶**C.B.Q. Liniment No. 1.** (*No.* 2 *not poison*).

✶**Celmo** *No.* 1.—*The proportions of the various constituents were determined as accurately as practicable, and indicated the following formula—Acetyl-Salicylic Acid* 35.5, *Powdered Charcoal about* 8.0, *Malt Extract, dry* 18.0, *Magnesium Silicate* 14.5, *other Mineral Constituents* 2.8, *Water* 12.3, *Alkaloid* 0.5 *Extractive* *about 8.0%. Oleo-resin of Capsicum a trace, Oil of Juniper, a trace.—B.M.J. ii./10,986.*

✱**Celmo No. 2.**—*An analysis showed these Tablets to contain Pepsin about 3 grains in each Tablet together with Diastase (probably in the form of Malt Extract) and Socotrine Aloes. No evidence was found of any other ingredient.—B.M.J. i./12,438.*

**Chameleon Oil.**—*A mixture prepared by the following formula agreed in physical and chemical properties with the original, except in regard to some minor characters of the Resins. Essential Oils of Mustard* 0.75, *Spearmint* 0.45, *Pimento* 1.5, *Cassia* 1.5, *and Camphor* 13.0, *Oil of Turpentine* 15.0, *Alcohol* (90%) 7.3, *Strong Solution of Ammonia* 8.0, *Resins* 1.6, *and Water to* 100. *All in parts by measure.—B.M.J. ii./10,983.*

Ⓟ✱**Chlorodyne, Dr. J. Collis Browne's.**—(*Coughs, etc.*) *Chloroform, Ether, Morphine, Cannabis Indica, Capsicum, Peppermint and Treacle.—L. ii./03,* 1493; *ii./06,*1390. *Does not now contain Hydrocyanic Acid. Pane found practically 2 grains actual Morphine in 1 ounce.—Pharm. Form.*

**Cicfa.**—*See " Mother's Advice."*

✱***Clarke's Blood Mixture.**—*Potassium Iodide* 52·5 *grains, Spirit of Sal Volatile* 10 *minims, Spirit of Chloroform* 67 *minims, Simple Syrup* 50 *minims, Burnt Sugar q.s., Water to* 8 *ounces.—L. ii./03,*1493; *B.M.J. ii./07,*530.

**Cocaphos.**—*Average weight of Tablets freed from coating was* 3.9 *grains. Analysis showed presence of Iron Hypophosphite* 20, *Quinine Sulphate* 2.8, *Extract* (*probably Damiana*) 50, *Sugar, Talc* 11%.—*B.M.J. i./11,27.*

✱**Cockle's (James) Pills.**—*Average weight* 4 *grains. Analysis indicated presence of Aloes, a little Soap, Powdered Colocynth, Powdered Jalap, and another vegetable tissue which did not agree in character with any drug now in ordinary use and which could not be identified.—B.M.J. i./11,1327.*

**Colman (The) Method.** (*For Catarrhs and Cold in the head*).

*The Nebular Tablets.—Average weight of a Tablet* 20 *grains. Analysis showed them to consist of Sodium Chloride* 28.3, *Borax* (*slightly dehydrated equivalent to crystalline Borax*) 28.7, *Sodium Bicarbonate* 29.5, *Sugar* 12.3, *Talc* 3.1%, *Oil of Wintergreen a trace. The* **Atomising Liquid** *was shown to consist of Liquid Paraffin with small quantities of Menthol and Oil of Cinnamon,—traces of other Essential Oils might be present.*

*The* **Gargle Tablets**, *average weight of a Tablet* 20 *grains, Analysis showed them to contain Borax* (*equivalent to crystalline Borax*) 4.6, *Sodium Bicarbonate* 87.0, *Sugar* 4.0, *Talc* 2.1, *powdered vegetable drug* (*possibly Hydrastis rhizome*) 1.5%, *Turpentine a trace.*

*The* **Pills.**—*Average weight ⅗ grain. Contain Aloin and indications of presence of Jalap Resin and Podophyllin.—B.M.J. ii./11,1545.*

✱**Coleman's Wincarnis.**—*Wineglassful* (2 *ounces*) *would contain Alcohol* 3 *drachms,* 8 *minims, Meat Extract* 10·5 *grains, Glucose* 159 *grains.—B.M.J. i./09,* 795.

**Collie's (Dr.) Ointment.**—*A similar Ointment was made by using following formula :—Black Resin* 12, *Beeswax* 2, *Crude Petroleum Jelly* 26, *Tallow* 20, *Lard* 40.—*B.M.J. ii./08,*1112.

Ⓟ**Compound Quinoleum** *contains Tinctures of Capsicum, Cantharides and Cinchona with Resorcin.—L. ii./08,*104.

✱**Congreve's Elixir.**—(*Cough Mixture*).—*L. ii./03,*1493.

*Analysis of the Elixir showed* 28·5% *by volume of Alcohol together with resinous material similar to the resins of Benzoin, Storax, Tolu or Balsam of Peru, Sugar about* 1%. *Alkaloid under* 0·001%.—*B.M.J. ii./08,*505.

*Carton round the bottle states 'no poison whatever' and this we have reason ourselves to believe.*

**Cotandin Compound.**—*Cascara, Hydrochloric Acid, Water.—L. ii./08,*104.

✱**Coza Powders.**—*Average weight* 1½ *grains,* 90% *Sodium Bicarbonate,* 5% *each Cinnamon and Cummin.—B.M.J. i./09,*909

**Cremalto.**—*Stated to be a combination of sterilised Devonshire Cream. Analysis showed Fat* 11·7%, *Reducing Sugars* (*as Maltose*) 56·3%, *Protein* 4·1%, *Ash* 1·3, *Water* 26·7%, *Diastatic Power of water-soluble portion* 6.—*B.M.J. i./10,*30.

Ⓟ**Crevoisier's (Asthma) Preparation.**—*Belladonna, Foxglove, Stramonium, Sage and Potassium Nitrate in equal parts.—L. ii./03,*1493.

**Crimson Cross Fever and Influenza Powder.**—*The Powder contained 99.4% of Ammonium Chloride, nothing else being found except the colouring matter which agreed with the reaction given by Tincture of Cochineal.—B.M.J. i./10,1121.*

**Crimson Cross No. 1 Ointment** (*Captain Feilden's*).—*Analysis showed it to contain—Copper Oleate* 1.1, *Anhydrous Sodium Sulphate* 0.4, *Beeswax* 6.5, *Resin (Colophony)* 29.6, *Linseed Oil* 62.4%.—*B.M.J. i./10,1121.*

**Crimson Cross Special Ointment.**—*Analysis showed this to contain Copper Oleate* 4.6, *Anhydrous Sodium Sulphate* 1.3, *Acetic Acid (Glacial strength)* 0.8, *Beeswax* 3.5, *Resin (Colophony)* 46.8, *Oily base (chiefly or entirely Linseed Oil)* 43.0%.—*B.M.J. i./10,1121.*

**Crimson Cross Kidney Cure.**—*Analysis showed that this fluid contained Glycerin about* 5%, *Alcohol* 4%, *Methyl Salicylate about* 0.05% *and a small proportion of vegetable extractive having no characteristic taste or property.—B.M.J. i./10,1121.*

**★Crosby's Balsamic Cough Elixir.**—*Contains* inter alia *Invert Sugar* 58%, *Alcohol* 10.6%, *Acetic Acid* 0.3% see B.M.J. (ref.) *Sulphuric Acid corresponding to 44 minims of the official dilute Sulphuric Acid in one ounce.—B.M.J. ii./08,1699.*

**Curic Wafers.**—*Acetanilide* 3.28 *grains, Phenacetin* 3.28 *grains, Caffeine Citrate* 1.64 *grains each.—B.M.J. ii./06,27.*

**★Cuticura.**—*Hard and Soft Paraffins, slightly perfumed with rose and coloured green.—B.M.J. i./08,943.*

**★Cuticura Resolvent.**—*Potassium Iodide, Sugar and Glucose, Extractive, Alcohol and Water.—B.M.J. i./08,944.*

**Dalby's Carminative.**—*Rhubarb, Magnes. Carb., Glycerin, Sugar, Peppermint Oil, Dill Oil, and a small quantity of Laudanum.—L. ii./03,1493. Proprietors say not a poison.*

**★Dale's, J. Gilbert, Treatment "Imperatine."** *The formula arrived at was,—in one dose (2 drachms) Potassium Iodide* 1.7 *grains, Ammonium Bromide* 17.4 *grains, Iron (calculated as Ferrous Sulphate)* 1.1 *grain, Alcohol* 5 *minims, Sugar, Burnt Sugar and Oil of Sassafras a trace.—B.M.J. ii./11,456.*

**★Damaroids.**—*Freed from coating the Tablets had an average weight of* 3.9. *grains. The figures arrived at were Iron Hypophosphite* 14.2, *Quinine Sulphate* 3.4, *Extract (probably Damiana)* 50, *Sugar, Talc* 16%.—*B.M.J. i./11,27.*

**Davis' Famous Female Pills.**—*Inter alia, Powdered Savin* 1½ *grain in each with Sulphate of Iron.—B.M.J. ii./07,1654. Proprietors say not a poison. A mixture made by them contains Gossypium.—ibid.*

**★Dethblo', Wilson's Patent Ringworm Cure.**—*Analysis indicated Ferrous Sulphate* 33%, *Acetic Acid (probably in the form of Vinegar, but estimated as Glacial)* 11.9, *Water to* 100.—*B.M.J. i./12,318.*

**★"D.D.D."** (*For eczema*). *Analysis showed,—Salicylic Acid* 0.75, *Phenol* 1.18, *Methyl Salicylate (Oil of Wintergreen)* 1.00, *Glycerin* 9.28, *Alcohol* 65.10. *by measure, Water to* 100 *parts by measure.—B.M.J. ii./10,1350.*

**★De Roos' (Dr.) Compound Renal Pills.**—*Freed from coating average weight of pills was* 4.5 *grains.—Contained Soap* 34.2, *Sodium Carbonate* 19.7, *a Resin (uncertain, probably Ammoniacum)* 3·3, *and a small quantity of vegetable tissue with moisture and extractive. Vegetable tissue could not be identified.—B.M.J. ii./11,78.*

**Dealin Powder.**—*The chief constituents of this preparation were Sodium Perborate* 20 *parts, Boric Acid* 10 *parts, Zinc Oxide* 10 *parts and* 60 *parts of a mixture of Talc with traces of Starch and Magnesium Carbonate.—B.M.J. i./10,761.*

**℗ Dill's Diabetic Mixture.**—*Formula found to be Sodium Bicarbonate* 7·4, *Extract of Hydrastis* 1.5, *Resin, Resinoids and other extractive* 2·20, *Alcohol* 35, *Water to* 100.—*B.M.J. ii./08,187.*

**Dipsocure.**—*Powders* 4·2 *grains. Composition,—Acetanilide* 6, *Potassium Bromide* 35, *Milk Sugar* 59.—*B.M.J. i./09,909.*

**Dixon's Pills.**—(*Aperient, Liver*) *Taraxacum, Podophyllin, Jalap and Soap.—L. ii./03,1493.*

**★Doan's (Back-ache Kidney Pills).**—1. *White-coated aperient Dinner Pills—Podophyllin, Aloin, Rhubarb and Peppermint* 2. *Brown-coated (Back-*

*ache) Pills—Oil of Juniper and a resinous constituent (? Benzoin). L. ii./03, 1493. B.M.J. ii./06,1646 gives as similar to the* **Dinner Pills** *a pill composed of Podophyllin, Aloin, Peppermint Oil, Jalap, Capsicum and Henbane Extract (this formula would of course be Ⓟ) ; and for the Backache Pills, Juniper Oil, Hemlock Pitch, Potassium Nitrate and Fœnugreek—in both instances with excipients in addition.—Parry has also reported on harmlessness of.*

***Doan's Ointment** (*for piles*) *Calomel* 36·3, *Zinc Oxide* 11·2, *Phenol* 1·3 *Beeswax* 2.3, *Soft Paraffin* 49.2%.—*B.M.J. ii./08,87.*

***Dodd's Kidney Pills.**—*A Pill containing Cascarilla, Jalap, Soap, Potassium Nitrate, Sodium Bicarbonate, Hard Paraffin, Turmeric and Wheat Flour is stated to be practically identical.—B.M.J. ii./06,1646.*

**Dumas', Madame, Pills.**—*Iron, Canella, Aloes, Pennyroyal.—B.M.J. ii./07,1855.*

**Dusart's Wine.**—*Alcohol* 16·85, *Glucose* 12·8, *Iron* 0·09, *Calcium* 0·07. *Phosphorus calculated as Phosphoric Acid* 0·03%.—*B.M.J. i./09,1309.*

***Dyxol.**—*A mixture prepared in accordance with the following formula was practically indistinguishable from the original :—Essential Oils of Mustard* 20, *Nutmeg* 20 *and Allspice* 4, *Cottonseed Oil* 6. *Liquid Paraffin (yellow)* 17, *and Kerosene* 33%—*all by volume.—B.M.J. ii./10,984.*

**Eau de Blanc de Perles.**—*Contains inter alia about* 15% *Lead Carbonate —Murrell.*

**Eade's Gout and Rheumatic Pills.**—*The formula was found to be Barbadoes Aloes* 10, *Colchicum Extract* 18, *Colchicum Corm. powdered* 35. *Treacle* 27, *Gum and Dextrin* 10%.—*B.M.J. ii./10,982.* Ⓟ *According to this Analysis.*

Ⓟ **Eau de Fleurs de Lys** *contains a trace of Corrosive Sublimate.—Murrell.*

***Eczoline Ointment.**—*Analysis showed Flowers of Sulphur* 39, *Zinc Oxide* 3.7; *Glycerin* 13.5, *Lard* 39.8, *Water* 4%, *Oil of Lemon a trace.—B.M.J. ii /10,1351.*

***Eczoline Tablets.** — *Analysis showed Ferrous Sulphate* 16·5, *Sulphur. (precipitated)* 56, *Talc* 3.4, *Starch* 7.3, *Extractive* 16.8. *The Extractive appears to be a mixture of Cascara Sagrado and an inert Extract,—the former constituting about* 5% *of the substance of the Tablets.—B.M.J. ii./10,1351.*

**Egg o-Tone** *consists largely of Epsom Salts, Borax and a little Quinine Sulphate L. ii./08,104.*

***Eno's Fruit Salt.**—(*Aperient*) *Sodium Bicarbonate, Tartaric Acid and Citric Acid.—L. ii./03,1493.*

**Epocol**—*B.M.J. i./10,762.*

Ⓟ **Espey's Syrup for babies** *was found to contain Cocaine.—L. ii. /08,104.*

***Eureka Consumption Cure** *appears to consist principally of Eucalyptus Gum (red gum) with a moderate proportion of Wood Tar and a little Eucalyptus Oil, —B.M.J. ii/09,247.*

**Fell Reducing Treatment.**—*Tablets would contain, according to analysis, Extract of Bladder Wrack* 0·07 *grain. Milk Sugar* 0·91 *grain (each Tablet had average weight* 1 *grain).—B.M.J. ii/08,1568.*

Ⓟ ***Fellow's Compound Syrup (of) Hypophosphites** *contains poison.—L. ii./06,1390—vide also Vol. I. p.* 607.

***Fenning's Children's Cooling Powders.**—*Average weight* 3·4 *grains. Analysis showed powder to consist of Potassium Chlorate* 70, *Powdered Liquorice* 30%.—*B.M.J. ii/08,1022.*

***Fenning's Lung Healers.**—*Average weight of one pill was* 0.22 *grains, chemical analysis and microscopical examination showed presence of Ipecacuanha only. Alkaloid present amounted to* 1.8%.—*B.M.J. ii./11,1543*

***Figuroids.**—*The large tablets contained by analysis Sodium Bicarbonate* 38·9- *Tartaric Acid* 13·1, *Sodium Chloride* 3·8, *Phenolphthalein* 1·2, *Formamine (Hexa, methylene Tetramine)* 2·0 *grains. The small Tablets* 11·9, 15·9, 7·6, 0·5 *grains respectively of the first four.—B.M.J. ii/08,1567 ; i/09,556.*

**Fitch's Kidney and Liver Cooler.**—*A solution of Potassium Nitrate.—B.M.J. ii./06,1647. The strength being* 56 *grains in a fluid ounce, i.e.,* 14 *grains in a dose.—Secret Remedies.*

**Fitzkure.**—*The formula indicated by analysis was in one dose (2 drachms) Potassium Iodide* 1·22 *grains, Ammonium Bromide* 29,3 *grains Potassium*

*Citrate 1.1 grains, Iron (calculated as Ferrous sulphate 0.55 grain, Alcohol 2 minims, Oil of Aniseed and Burnt Sugar a trace.—B.M.J. ii /11,458.*

**Forde's (Chas.) Bile Beans** see **Bile Beans.**—

Ⓟ **Freeman's Chlorodyne** '*contains less than 1% Morphine and does not contain Prussic Acid.'—By the Makers.*

**Mrs. Frost's Anti-Obesity Remedy.**—*The active ingredient is Extract of Fucus Vesiculosus.—L.ii./03,1493.*

✶**Fucol** *is Sesame Oil containing a small quantity of Iodine. It is said to be made from Seaweed.—B.M.J. i./07,879.*

**Gautier's Female Pills.**—*Freed from coating the pills had an average weight of 3.8 grains. Analysis showed a small quantity of Aromatic Essential Oils (Pennyroyal, Rue and possibly Tansy) and probably Apiol. Principal constituents were Exsiccated Sulphate of Iron 10% and Soap 11%, Powdered Liquorice 30%, a little Powdered Ginger, and a small quantity of apparently Socotrine Aloes.—B.M.J. ii./11,35.*

Ⓕ **Gelineau's Dragèes** *for Epilepsy are stated to contain Potassium Bromide, 1 in 1000 Antimony Arsenate and 1 in 2,000 Picrotoxin. (Might be viewed as* Ⓟ.)

✶**Genoform.**—*Formula of the Tablets is Salicyl-Methylene-Glycol-Ester 95, Starch and moisture 5%.—B.M.J. ii/08,1113.*

**Giant Remedy. The**—see **Box's Pills and Golden Fire.**—

**Glendenning's Beef and Malt Wine.**—*Wineglass (2 ounces) contains Alcohol 3·33 drachms, Meat Extract 3·5 grains, Glucose 93 grains.—B.M.J. i /09,796.*

✶**Gloria Tonic.**—*(Gout and Rheumatism) Tablets. The following formula was indicated; Potassium Iodide 1·8, Guaiacum Resin 0·8, Ext. Liquorice 1·0, Resinoid (Phytolaccin ?) 0·9, Powdered Liquorice 1·7, Rice Starch 2·0, Talc and Kaolin 2·1 grains.* ✶**Gloria Pills.**—*Following was indicated: Extract of Cascara 0·3, Ext. Soc. Aloes 0·5, Jalap Resin 0·07 grain, Flour and excipient q.s. in one pill.—B.M.J. ii/08,1111; see also L. ii./03,1493.*

**Glykaline.**—*(For coughs, colds, catarrhs, etc.) Analysis showed the liquid to contain 35% of Alcohol and 0.15% of solid matter consisting of Potassium Iodide and partly of organic matter. Each dose would contain* $\frac{1}{350}$ *grain of Potassium Iodide, with a trace of organic matter which may be derived from some drug.—B.M.J. ii./11,1544.*

**Goat Lymph Tablets** *contain Strychnine Phosphate, Zinc Sulphide, Ext. Muira Puama, Arenine and Cannabin.—L. ii /08,104 (Presumably* Ⓟ)

*We understand these Tablets—one brand at any rate—are only supplied to the medical profession.*

✶**Golden Fire.**—*The following is the formula given by the analyst:—Oil of Amber 0.16, Oil of Rosemary 0.16, Oil of Eucalyptus 0.32, Oil of Camphor (essential) 1.3, Sodium Chloride 6.4, Glacial Acetic Acid 6.4, Alcohol 1.0 and traces of decoction of Capsicum, Barley and Lobelia.—B.M.J. ii./10,987.*

✶**Gordon's Vital Sexualine Restorative,** see **Vital Sexualine.**

✶**Gower's Green Pills.**—*Analysis showed Soap (about 36%) an alkaline Salicylate (about 37%), Extractive and vegetable tissue—? Cimicifuga.—B.M.J. ii./08 1112.*

**Grey's Specific.**—*(Obesity) Contains 47 2% Free Sulphur and a Bitter (? Gentian).—L. ii./03,1493.*

**Guy's Tonic.**—*Phosphoric Acid, Tinct. Cochineal, Inf. Gentian and Chloroform Water.—L. i./03,1493. B.M.J. i./11.26 gives the following formula as an exactly similar mixture,—Dilute Hydrochloric Acid 0.59, Dilute Phosphoric Acid 0.52, Alcohol 2.27, Compound infusion of Gentian 40, Chloroform Water 50, Cochineal q.s. Water to 100 parts by measure.*

**Hæmatoba** *(for piles).—Analysis showed it to be an aqueous liquid containing about 0·09% of a bitter amorphous alkaloid and 2·7% of vegetable extractive, including a little of a substance of the nature of a tannin but not ordinary Tannic Acid.—B.M.J. ii./08,87. This may be* Ⓟ.

**Hair's (Dr.) Cure for Asthma.**—*A fluid containing 5·6% Potassium Iodide, Tar Water and some Wine.—L. ii./03,1493; B.M.J. i./07,879.*

✶**Hall's Coca Wine**—*Alcohol 17·85, Glucose 11·9, Alkaloid 0·0063%. Composition now different from the statement in L. April 9, 1892.—B.M.J. i./09,1307.*

**Hammond's Specifics,**—*See Uricura,*

**Hamm's Rheumatic, Gout, and Sciatica Cure.**—*Potassium Iodide* 15 *grains, Sodium Salicylate* 66 *grains, Extractive* 28 *grains, Alcohol a trace, Water to* 8 *ounces.—B.M.J. ii./*08.1111.

**Hargreaves' Reducing Wafers.**—*Fucus and Liquorice.—B.M.J.ii./*07,209.

**★Harlene, Edward's.**—*Borax* 0·5%, *Additional Alkali—equivalent to anhydrous Sodium Carbonate* 0·04%, *Solution of Ammonia* (10%), 0·12%, *Glycerin* 0·4%, *Colouring Matter and Perfume a trace, Alcohol* 5·7%, *Water to* 100, *by volume.—B.M.J. i./*10 151.

**Harvey's Blood Pills.**—*Contain among other ingredients about* $\frac{1}{2}$ *grain each Quinine Sulphate, about* $\frac{2}{3}$ *grain Potassium Iodide and about* $\frac{1}{2}$ *grain Rhubarb. —B.M.J. ii./*07,530.

**Hayes', Dr. Harold, Asthma Medicines.**—(1) *Turpentine and Peppermint in Emulsion, Dose,* 20 *to* 30 *drops.* (2) *A mixture of Potassium Iodide, to which Wine, Hydrochloric Acid and Sugar is added.* *Dose,* 15 *minims t.d.s.* (3) *Iodides of Potassium, Sodium and Ammonium* 6·7% *in a mixture. Dose,* 30 *minims in the evening.* (4) *Solution of Iron Peptonate. Dose,* 15 *minims t.d.s.* (5) *Capsules of Quinine Sulphate* $1\frac{1}{2}$ *grains.* (6) *Jalap Resin Pills.—B.M.J. i./*07,879.

**Head Powders** *prepared by Daisy, Ltd., consist of Phenacetin alone.—Secret Remedies.*

**Headache Powders** *usually contain Acetanilide,* 3 *grains each.*

**Healine** (*for rupture*).—*Analysis of Pills gave indefinite results. c.f. B.M.J. ii./*08,1193.

**Hochfelder Pitch Plaster.**—*B.M.J.i./*10,761.

**★Hoffman's Harmless Headache Powders.**—*Analysis showed Acetanilide* 5·02 *grains, Cocoa* 4·02 *grains, Sodium Bicarbonate* 1·01, *as one powder. —Secret Remedies.*

**Hoffmann-s (Dr.) Rheumatic Powders** :—
*Analysis showed the following composition,—Acetyl-Salicylic Acid* 66.4 *Phenacetin* 11·4, *Caffeine* 1.3, *Sugar* 20.1 *Moisture* 0·8%.—*B.M.J.ii./*10, 982.

**★Holloway's Ointment.**—*Fresh Butter, Beeswax, Yellow Resin, Vinegar of Cantharides, Canada Balsam, Expressed Oil of Mace, Balsam of Peru or Liquid Storax.—Murrell.*

*We understand, however, from the makers that this contains nothing of a poisonous nature, and is not* Ⓟ.

**★Holloway's Pills.**—*B.M.J. i./*11,1326 *states "The Pills had an average weight of* 1.4 *grains, examination showed the presence of Aloes (Barbadoes) or a preparation of Aloes, Powdered Ginger and Soap."*

**Holroyd's Gravel Pills.**—*Average weight of Pill freed from coating was* 4.3 *grains. From analysis the following formula was arrived at—Soap* 40. *Dried Sodium Carbonate* 20, *Powdered Rhubarb* 20, *Oil of Anise* 10, *Syrup* 10.—*B.M.J. ii./*11,77.

**★Home Docter (The) Backache and Kidney Pills.**
*Freed from coating the Pills had an average weight of* 3.3 *grains. The formula was found to be approximately—Oil of Juniper* 3, *Potassium Nitrate* 26, *Magnesia* 8, *Powdered Capsicum* 20, *Sugar* 17, *Soap* 1, *Starch, Gum, Moisture, etc., to* 100. *B.M.J. ii./*11.78.

**★Homocea.**—*Analysis gave the following :—Eucalyptus Oil* 25. *Lemon Oil* (?) 0.2, *Beeswax* 25, *Fat* 49, *Solution of Ammonia* 0.8%.—*B.M.J. ii./*10,1350.

**Hood's Sarsaparilla.**—*Dose* $\frac{1}{2}$ *to* 2 *teaspoonfuls. Analysis indicated* 19% *by volume of Alcohol and* $7\frac{1}{2}$ *grains of Potassium Iodide in the ounce, the amount of Sarsaparilla being small.—B.M.J. ii./*07,531.

**Hood's Vegetable Pills.**—*After removal of coating average weight was* $\frac{1}{2}$ *grain. Examination showed Aloes (Barbadoes) or a preparation of Aloes,—probably Aloin, Ginger, Capsicum, Colocynth, Soap and probably a little Jalap. —B.M.J. i./*11,1327.

**Hooper's, Dr. John, Female Pills.**—*Analysis showed Iron Sulphate, Aloes, Jalap, Canella, Senna and Oil of Pennyroyal.—B.M.J. ii./*07,1653.

**★Horton's Benedict Pills.**—*Average weight* 4 *grains. Analysis showed Sulphate of Iron corresponding to* 10% *Exsiccated Sulphate, Socotrine Aloes, Powdered Ginger and a vegetable powder probably Gentian.—B.M.J. ii./*11,36.

**★Hughes' Blood Pills.**—*Contain Aloes, Jalap, &c.—B.M.J. ii./*07,532.

**★Hughes' XL. Reducing Pills** *have Fucus* 2·2 *grains as basis with a little Potass. Iodide and Iron Phosphate, also Ginger and Liquorice.—B.M.J. ii./*07,150.

✱**Hughes' XL. Reducing Lotion** *contains 13½ grains of Bromide and 9½ grains Iodide of Potash to the ounce, inter alia.—B.M.J. ii./07,150.*

**Hyomei.**—*From analysis and examination it was concluded that Alcohol and Liquid Paraffin formed each about 10% of the whole, Eucalyptus Oil (and possibly other Oils) appears to form the remaining 80%,—a small proportion of a mixture containing Wood Tar and Creosote was also indicated.—B.M.J. ii./11,1544.*

✱**Imperatine Treatment for Epilepsy,** *see* **Dale's.**

**Indian Tincture.**—*Capsicum, Cannabis Indica, Ether and Methylated Spirit.—Murrell.*

Ⓟ **Injectio Brou.**—*Zinc Sulphate, Sugar of Lead, Laudanum, Tinct. Catechu and Water.—Murrell. Pharm. Form. says :—Zinc Sulphate* 15 *grains, Lead Acetate* 30 *grains, Catechu Tincture* 1 *drachm, Tinct. Opii Crocat,* (*q.v.*) 1 *drachm, Water to* 6 *ounces, is generally adopted in making imitations.*

**Invigoroids.**—*The formula arrived at was :—In one Tablet Ext. Nucis Vom.* 0.028 *grain, Zinc Phosphide* 0.067 *grain,* (*calculated from Zinc present*). *Saccharated Carbonate of Iron* 0.50 *grain, Asafoetida* 0.25 *grain with some Sugar of Milk.—B.M.J. i./11,91. This may be* Ⓟ

✱**Irristum.**—*A Syrup of Phosphate of Iron with Quinine.—B.M.J. ii./07,1658.*

**I.R.S. Compound Golden Tablets.**—*Contain Ferrous Sulphate and Sodium Carbonate.—B.M.J. ii./07,1658.*

**James' Fever Powder.**—*Antimonious Oxide* 1, *Calcium Phosphate* 2.

✱**Jefferson Dodd's Corrective.**—*Contains Dec. Aloes Conc. with Chloroform Water and Water. Pills are Iron and Aloes.—B.M.J. ii./07,1654.*

✱**Johnson's (Mrs.) American Soothing Syrup.**—*Analysis showed in* 100 *by measure Sodium Chloride* 5.66, *Hydrochloric acid* (*B.P.*) 2.33 *by measure Reducing Sugars, calculated as Glucose* 66.6, *extractive coloring matter etc. about* 5.0. *The reducing Sugars appeared to be present in the form of Honey, representing about* 85 *parts of this.—B.M.J. i./12,683.*

**Juvenia.**—'*Liquid No.* 1' *Solution containing* 2% *Hydrogen Peroxide,* ⅔ *strength of* '10 *volume.*' '*Liquid No.* 2' *Paraphenylene Diamine* 0·9%, *Solution of Ammonia* 0·6%. *and trace of fixed Alkali.—B.M.J. i/10,153.*

✱**Kaputine** (*for Headache and Neuralgia*).—*Contains Antifebrin* 6·3 *grains in each, with Sugar* 0·21 *grains, and coloured with Ferric Oxide* 0·05 *grain.—L. ii./03,1493; B.M.J. ii./06,28.*

**Kargon Compound** *contains Fluidextract of Buchu, Potassium Acetate, Methyl Salicylate and Sugar.—L. ii./08,104.*

✱**Karox Compound.** — *The contents of several bottles of this preparation were examined and were found to differ very considerably in composition. Magnesium Sulphate varied from* 1.45 *to* 6.87%, *Potassium Citrate from* 4.76 *to* 6.55%, *Sugars about* 8%. *The Alcohol in one specimen was* 6%, *Nitrous Ether was present and a trace of Nitrite, Vegetable Extractive was between* 1 *and* 2% *but showed no characters indicative of its source. Microscopical examination of the sediment showed the presence of yeast-like cells and the minute plants known as desmids.—B.M.J. ii./11,79.*

Ⓟ ✱**Kay's Essence of Linseed.**—*Contains Poison.—L. /ii.06,1390.*
100 *parts contained* 1·07 *parts of Chloroform, and* 4·3 *parts of Alcohol both by measure,* 67 *parts of Solids,—about* 48 *parts of the latter sugar, and the remaining* 19 *parts consisted principally of the mucilage of decoction of linseed. Ipecacuanha alkaloids extracted amounted to* 0·007%, *and the Morphine to* 0·021%.—*B.M.J. ii./08,1698.*

✱**Kay's Tic Pills.**—*Iron Sulphate, Quinine and Soap.—L. ii./03,1493.*

Ⓟ ✱**Keating's Pectoral Lozenges.**—*Corresponded to Morphine* 0·007 *grain, Ipecacuanha* 0·07 *grain, Extract of Liquorice* 2·1 *grain, Sugar* 13 *grains in one lozenge.—B.M.J. ii./08,1699.*

✱**Keene's "One Night" Cold Cure.**—*Ingredients found were Cinchonidine Sulphate* 0·21 *grain. Acetanilide* 0·32 *grain, Calcium Carbonate* 0·25 *grain, Starch* 0·34 *grain, Extractive and excipient* 0·87 *grain (all figures approximately).—B.M.J. ii./08,1286.*

**Kellogg's Safe Fat Reducer.** — *The Tablets had average weight of* 70 *grains and contained Starch, Dextrin, Glucose or Maltose, Protein, Mineral Salts, Vegetable tissue and small quantity of an organic compound containing*

*Iodine, probably Thyroid Gland. Wheaten flour (with some of its Starch removed) massed with Malt Extract or Glucose and Thyroid Gland or Extract seemed to agree with the original.—B.M.J. i./11,824.*

✶**Kepler Solution of Cod Liver Oil in Malt Extract.**—*Analysis showed Oil* 17.4%, *Reducible Sugar (as Maltose)* 42.5, *Protein* 3.4, *Diastatic Power* 3.—*B.M.J. i./10,30.*

✶**Ker-nak Pills.**—*Average weight without coating* 1½ *grain. Examination indicated Aloes, a little Soap, a very little Oleo-resin of Capsicum, and a little vegetable tissue resembling Marshmallow root.—B.M.J. i./11,1327.*

✶**Kidd, J. W. Co. (Dr.) Preparations.**—*Tablet A.B, also* 18, 45 *and* 7 *examined.—B.M.J.i. 09,672.*

✶**Kilmer's (Dr.) Indian Cough Cure.**—*Contains inter alia (see ref.)* 0·5% *Oil of Pumilio Pine. No alkaloid —B.M.J.ii./08,1698.*

✶**Kilmer's (Dr.) Swamp Root.**—*The following formula when made up on results of analsyis agreed well with the original in degree of bitterness and strength of Wintergreen :—Sugar,* 46.5, *Alcohol,* 10.5, *Extract Cascara Sagrada* 2, *and Oil of Wintergreen* 0.5%. *The sediment of the original mixture when examined with the microscope showed traces of vegetable tissue in considerable variety.—B.M.J. ii./11,79.*

**Kola Wine, Christy's.**—*Alcohol* 18.85, *Glucose* 8.6, *Alkaloid (with characteristics of Caffeine)* 0.03. *Each fluid ounce represents* 6½ *grains of Kola. B.M.J. i./09,1307.*

✶**Koko.**—*Borax* 1.4, *Glycerin* 1.7, *Formaldehyde Solution* (40%) 0.1, *Perfume a trace, Alchol* 3, *Water to* 100 *by volume.—B.M.J. i./10,151.*

**Lady Webster's Pills.**—*Aloes* 2 *grains, Powdered Mastiche* ½ *grain, Rd Rose Leaves* ½ *grain with Syrup of Wormwood.—Murrell.*

**Lamplough's Pyretic Saline** *(Aperient).—Citric Acid, Potassium and Sodium Bicarbonates.—L. ii./03,1493.*

**Lane's (Dr.) Catarrh Cure.**—*Analysis showed Phenol* 0.4, *Sodium Chloride* 3.3, *Water to* 100.—*B.M.J. ii./08,1285.*

✶**Laville's Gout Cure.**—*Contains Veratrine.—B.M.J. i./04,1296. Colchicine about* 0.08% *and Quinine in Alcoholic Solution.—B.M.J. ii./07,677 (latter more likely.—W.H.M.).* Either form would make the preparation Ⓟ. —It is so labelled.

*The following is similar, (Ph. Form 701)—Quinine* 4 *drachms, Colocynth Extract* 2 *drachms, Alcohol* 90% 4 *ounces, Malaga Wine* 15 *ounces. Mix and filter. Dose,* ½ *to* 4 *drachms in* ½ *wineglass of water.*

*The Pills are (Ph. Form. 744) Extract of Winter Cherry* 3 *dr., Sodium Silicate* 1 *dr. Make a mass and divide into* 5 *grain Pills. Dose,* 4 *to* 10 *daily. Guaiacum Resin a constituent with the Silicate and Water Cherry and other ingredients.—Vide Secret Remedies.*

**Lecoy's (Dr.) Vigoroids.**—*Analysis showed Ferrous Phosphate about* 0.19 *grains in each tablet, Quinine, Strychnine (the Quinine and Strychnine together being about* 0.09 *grain in each tablet,—the Strychnine not more than* 0.005 *grain in each tablet) a Vegetable Extract, Sugar, Starch, Talc.—B.M.J. ii./10,1928.—Ⓟ According to this Analysis.*

✶**Lemco Meat Wine.**—*A wineglassful* (2 *ounces) would contain Alcohol* 2.75 *drachms, Meat Extract* 5.2 *grains, Glucose* 112 *grains.—B.M.J. i./09,795.*

**Levasco.**—*A mixture prepared in accordance with the following formula was practically indistinguishable from the original :—Oleo-resin of Capsicum* 3 *grains, Camphor* 6 *grains, Oil of Lavender* 3 *minims, Oil of Rosemary* 4 *minims, Soap* ½ *grain and Methylated Spirit to* 1 *ounce.—B.M.J. ii./10,984.*

**Levathin.**—*German proprietary in tablet form, consisting of about* 75% *Cream of Tartar and* 15% *of the Sodium Salt and* 10% *Cane Sugar.— B.M.J. ii./08,204.*

✶**Licoricine.**—*Does not contain poison—L. ii./06,1360.*

**Liebig's Meat and Malt Wine.**—*See Lemco.*

**Limosan.**—*B.M.J. i./10,762.*

✶**Liqufruta** *(A Consumption Cure).—Analysis showed Oil Peppermint Onion or Garlic Oil and Alkaloids, of each traces, Potassium Bitartrate* 0.4, *Glucose* 3.44, *Cane Sugar* 2.28, *Mucilage, Tannin, Extractive, etc., and water to* 100.—*B.M.J. ii./09,1419.*

**Lockyer's Sulphur Hair Restorer.**—*Precipitated Sulphur* 1.3%, *Lead Acetate* 1.6, *Lead Sulphate* 0.4%, *Glycerine* 9.6%, *Rose Water to* 100 *by volume.—B.M.J. i./10,151.*

**Locock's Pulmonic Wafers.**—*Lactucarium, Ipecacuanha and Squills.* —*Murrell.* This form would make the preparation Ⓟ.

✱**McKenzie's (Dr.) "One Day" Cold Cure.**—*Analysis showed the Tablets to have composition Cinchonidine Sulphate* 0.83 *grain, Acetanilide* 0.71 *grain, Camphor* 0.1 *grain, Talc* 0.21 *grain, Water* 0.15 *grain.—B.M.J. ii./*08, 1285.

**Magic Foot Drafts.**—*Analysis of the plaster showed the formula to be approximately,—Powdered White Hellebore* 40%, *Stockholm Tar* 60%.—*B.M.J. ii./*10,985.

Ⓑ**Make-Man-Tablets.**—*contain Iron, Arsenic, Valerianic Acid and Hops.* —*L. ii./*08,104.

**Maltico.**—*Described as a perfect infant food." "Analysis showed Fat* 3.9%, *Reducing Sugars (as Maltose)* 66.5% *Protein* 16·8%, *Ash* 4.6%, *Water* 3.6%.—*B.M.J. i./*10,30.

**Mariana Wine.**—*Alcohol* 36.3, *Total Solids* 30.3, *Ash* 0.2, *Reducing Sugar (as Glucose)* 9.8, *Cane Sugar* 17.5, *Alkaloids* 0.025.—*B.M.J. ii./*09,562.

✱**Marmola.**—*Quantitative determination difficult.*
*Formula arrived at was—Dried Thyroid Gland* 1.4 *grain, Phenolphthalein* 0.4 *grain, Sodium Chloride* 0.7 *grain, Powdered Fucus Vesiculosus* 5 *grains Extractive* 2.5 *grains, Oil of Peppermint trace.—B.M.J. ii./*08,1566. *Another analysis, L. ii./*08,104.

**Marston Treatment.**—*Three 'grades' of Suppositories.—Average weight* 16.5 *grains. Analysis showed Calcium Hypophosphite* 0.4 *to* 0.3, *Powdered Gentian and Cinchona Bark* 2.1 *to* 3.7, *Oil of Theobroma* 97.5%.—*B.M.J. i./*11,93.

**Martin's Apiol and Steel Pills.**—1½ *grains of Aloes in each with, inter alia, reduced Iron and Apiol each* $\frac{1}{10}$ *grain.—B.M.J. ii./*07,1655.

✱**Martin's (Dr.) Miracletts.**—*Results of analysis indicated Quinine Valerianate* 0.4, *Zinc Valerianate* 0.1, *Ferric Oxide* 0.3, *Menthol* 0.03 *grain, Kaolin and Talc* 2.3 *grains.—B.M.J. i./*09,31.

**Martin's Mixture Antidiabetique.***Apricot Kernel Oil.—L. ii./*08,104

**Matrozone.**—*Analysis of the liquid in a bottle marked "A" showed it to contain* 68 9% *(by volume) of Alcohol, and water. The total solid matter was too small in amount to be weighed (unless by working on a large amount of the liquid), and might easily be accounted for by tap water having been used to dilute the Alcohol.—No trace of alkaloid was shown by the most delicate test. The liquid in a bottle marked "B" contained* 60.3% *alcohol by volume, and resembled "A" in other particulars.—B.M.J. ii./*11,37.

**Maxwell's Canadian Pills.**—*Freed from coating average weight* 5.1 *grains. Analysis showed evidence of the presence of Socotrine Aloes, Powdered Cinnamon and a small proportion of another vegetable powder, a resinous substance, a trace of alkaloid and extractive. It was not found possible to detect any definite ingredients besides those named.—B.M.J. ii./*11,36.

**Menstruation Powders.**—*Particulars are given of several consisting of Chamomile only.—B.M.J. i./*10,1189.

✱**Mer-Syren Powders.**—*Indigestion and dyspepsia.*
*Average weight* 25½ *grains. Microscopical examination showed the presence of potato starch. No other substance could be detected.—B.M.J. i./*11,1325.

✱**Mexican Hair Renewer.**—*Precipitated Sulphur* 1.4%, *Lead Acetate* 0.1 *(one sample examined contained* 0.97%), *Glycerin* 19.0%, *Rose Water to* 100 *by volume.—B.M.J. i./*10,512.

**Migranol.**—10% *Solution of Menthol in Acetic Ether with* 4% *Spiritus Dzondii (q.v. in text) with Camphor and some sweet smelling Ethereal Oils.—B.M.J. i./*07,879.

**Miol.**—*Analysis showed it to contain Oil* 22.4%, *Reducing Sugars (as Maltose)* 41.3%. *Diastatic power* 2.—*B.M.J. i./*10,30.

✱**Monaid Tablets.**—*Contain Caulophyllin and Capsicum.—B.M.J i./*07 1606.

**Morgan's (Dr.) Radio-Vimettes**, *see* **Radio Vimettes.**

✱**Morison's Pills.**—*(For Obesity).* *One contains Aloes, Jalap, Resin, Cream of Tartar, and probably Colocynth; the other some Gamboge as well.—B.M.J. i./*07,832.

**Mothersill's Seasick Remedy.**—*Contents of Capsules—a pink and a brown powder on analysis gave the following :—*

*Pink Powder.—Sugar of Milk* 33.3, *Caffeine* 8.2, *Stearic Acid* 18.0, *Chlorbutol* 40.1%, *colouring matter a trace.*

*Brown Powder.—Powdered Cinnamon* 29.4, *Caffeine* 8.4, *Stearic Acid* 17.4 *Chlorbutol* 44.5%. *Stearic Acid is probably added as a lubricant to assist in filling the capsules though the amount is large for the purpose.—B.M.J.* ii./10, 1928.

✶**Mother's Advice.**—*Recently Tablenes and formerly 'Cicfa' and before that 'Tablones.' Contained Pepsin, Diastase and other ingredients.—B.M.J. i.*/09,556.

*B.M.J.* i./11,1325, *now gives the following:—Analysis showed presence of Pepsin corresponding to* $\frac{2}{3}$ *grain Pepsin B.P., diastase, reducing sugar (apparently Maltose), a bitter extract agreeing in characters with Ext. Cascara Sagrada about* $\frac{1}{4}$ *grain, a pungent substance which appeared to be Oleo-resin of Capsicum about* $\frac{1}{300}$ *grain Talc and a little starch probably derived from the coating.*

**Mrs. Frost's Anti-Obesity Remedy** *see* **Frost's**

**Mrs. Lydia E. Pinkham's Vegetable Compound** *see* **Pinkham's**

**Mrs. Seymour's Treatment—Obesity** *see* **Seymour's.**

**Mrs. Shaffer-Bennyon's Remedy** *see* **Shaffer-Bennyon's.**

**Mrs. Stafford-Brookes' Pelloids** *see* **Stafford Brookes.**

**Mrs. Terry's Drink Cure** *see* **Terry's.**

✶**Munyon's Blood Cure and Munyon's Kidney Cure.**—*Granules, entirely Sugar (quantitative determination showed just* 100%*).—B.M.J. i.*/07,213; *ii.*/07,531.

✶**Munyon's Catarrh Tablets.**—*Analysis showed Sodium Bicarbonate* 1.87 *grains, Sodium Chloride* 1.81 *grains, Borax, partly dehydrated* 2.2, *grains, Phenol traces, Gum* 0.12 *grain.—' Secret Remedies.'—B.M.J. ii.*/08,1286.

✶**Munyon's Special Catarrh Cure.**—*Determination showed these pilules to consist of* 100% *sugar.—B.M.J. ii.*/08,1286.

✶**Munyon's Pile Ointment** *consists of Soft Paraffin with trace of Ichthyol, probably less than* 0.2%.*—B.M.J. ii.*/08,87.

**Murray's Combined Treatment.**—

*Gelatinoids No.* 1.

*Each contained Quinine Sulphate* 0.75 *grain,—no other substance was present*

*Gelatinoids No.* 2.

Ⓟ *Ferrous Phosphate* 26%, *Quinine Phosphate* 35%, *Strychnine, small proportion, Talc* 11%, *Milk Sugar*

*Gelatinoids No.* 3.

*Consisted of a brown extract agreeing in most characters and tests with extract of Damiana, some other vegetable extract might be present.*

*Suppositories—Three kinds.*

*Calcium Hypophosphite* 3.54—4.05, *Powdered Gentian and Powdered Cinchona Bark (together)* 3.90–5.3, *Oil of Theobroma* 91 *to* 92.05%.*—B.M.J.* i./11, 93.

**Nelson-Lloyd Safe Reducing Treatment.**—*The Tablets contained inter alia (see ref.), Bladderwrack Extract and Thyroid gland proteid.* Liquid *similar.—B.M.J.* ii./08,1568, *or vide Secret Remedies.*

✶**Nervelettes, Coleman's.**—*Phosphorus* 0.005 *grain and Quinine Sulphate* 0.07 *grain with vegetable matter* 0.3 *grain were determined.—B.M.J. i.*/09,32.

**Nervol.—Dr. Ray's.**—*An aqueous extract of indifferent vegetable substances, with Valerian* 3%. *Alcohol and Glycerin added also* 6% *Potassium Bromide.—B.M.J. ii.*/08,204. (*See also Ray's Pills.*)

Ⓟ **Neuraline.**— *Aconite with Chloroform and Rose Water.— Murrell.*

**Neurovril.**—*Analysis showed that* 100 *parts (by measure) contained* 18.9 *parts (by measure) of Alcohol and gave* 19.1 *parts of residue on evaporation, of which* 18.1 *parts consisted of Sugar. No appreciable amount of " serum " or other animal substance was present. If the " active principle " contains as stated on label* 75% *of Phosphate and* 20% *of albumen, it follows from the analysis that only a minute trace of it is present in the liquid which is practically a mixture of simple syrup and diluted alcohol.—B.M.J. i.*/12,26.

**Niblett's (Dr.) Vital Renewer.**—*The formula indicated by results of analysis is in one dose (1 drachm) Potassium Iodide* 2.07 *grains, Potassium Bromide* 15.6 *grains, Ammonium Bromide* 4.2 *grains, Chloroform, Oil of Aniseed, Alcohol and Burnt Sugar, traces.—B.M.J. ii.*/11,458.

**Ninetta** (*a nutrient cream for the breasts*) *consists of a powdered leguminous flour with sugar and lecithin.—Deut. Med. Woch., Sept.* 15/10..—*Ex. B.M.J. ii.*/10,1900.

**" Normal " Pills.**—(*For reducing obesity*).

*Each pill contained approx. Ext. Cascara* ¼ *grain, Ext. Fucus vesiculosus* ½ *grain, Liquorice Powder* ¼ *grain, Talc and moisture* ¼ *grain.—B.M.J. i.*/11,825.

✶**Norton's Chamomile Pills.**—*Aloes, Gentian and Chamomile Oil.—Murrell.*

**Nurse Grey's American Compound Tablets.**—*Average weight of* 2.5 *grains. Analysis showed principal constituent was Ferrous Carbonate*—20 *per cent., Talc* 19 *per cent. with glucose and starch, no other medicinal substance could be detected.—B.M.J. ii.*/11,35.

**Nurse Hammond's Improved Remedies.**—*Mixture, Pills, and Tablets.*

*The Mixture, ' Treatment No. 2,' contained* 2.8% *by volume of Alcohol, between* 2 *and* 3% *Glycerin, and a very little extractive. No active principle of any sort could be detected beyond a minute quantity of an alkaloid, and there was no evidence of any other medicinal substance.*

*Pills.—Freed from coating, weighed on average* 2.9 *grains. Analysis showed the principal ingredient was Ferrous Carbonate* 17% ; *other ingredients were Soap* 1%, *Powdered Liquorice Root, Wheat Starch, Sodium Sulphate (formed in the production of the Ferrous Carbonate), and excipients. No alkaloid was found.*

*Tablets.—Freed from coating, average weight was* 4.1 *grains. Analysis showed presence of Aloin, Powdered Tansy Herb, Powdered Liquorice and Talc.—B.M.J. ii.*/11,34.

✶**Nurse Lilly's Female Pills.**—*Freed from coating, average weight was* 1.9 *grains. Contain Sulphate of Iron,* 12%, *Socotrine Aloes, Cinchonine Sulphate* 3.3%, *Powdered Capsicum about* 30%, *a little Powdered Ginger and Pennyroyal.—B.M.J. ii.*/11,36.

**Nurse Mann's Remedy.**—*Pills. Freed from coating, average weight was* 3.2 *grains. Analysis showed Sulphate of Iron, Barbadoes Aloes, Soap, Powdered Ginger Cardamom and Cinnamon. Traces of Oil of Rue and Apiol suspected.—B.M.J. ii.*/11,35.

✶**Oquit.**—*Analysis of the Tablets showed them to contain Acetyl-Salicylic Acid* 66·2, *Starch* 20, *Talc* 4·2, *Gum* 1·5, *Extractive* 3·1, *Moisture* 5·0%, *Alkaloid a trace.—B.M.J. ii.*/08,1113.

**Orange Blossom Specific for Uterine Diseases.**—*Principal constituents found to be Alum and Boric Acid, the basis being Soft Paraffin.—B.M.J. ii.*/09.1419.

**Osborne's Mixture** (*in epilepsy*).—*Contains about* 20 *grains Potassium Bromide in a dose.—B.M.J. ii.*/04,1586.

✶**Osogen.**—*Determination of the various ingredients gave the following formula : Quinine Glycerophosph.* 0.75 *parts, Iron Glycerophosphate* 2.14 *parts, Magnesium Glycerophosphate* 0.77 *parts, Sodium Glycerophosphate* 0.9 *parts, Spirit of Chloroform* 3.8 *parts by measure, Glycerin* 73 *parts by measure, Water to* 100 *parts by measure.—B.M.J. i.*/12,27.

**Ovaltine.**—*Described as ' composed of Malt Extract, Fresh Swiss Cow's Milk, Fresh Eggs, and converted Cocoa, and containing active Lecithin.' Analysis showed Fat* 12·3%, *Reducing Sugars (as Maltose)* 60·0%, *Nitrogenous substances calculated as Protein* 13·4%, *Ash* 3·5%, *Water* 1·5%.—*B.M.J. i.*/10,30.

✶**Owbridge's Lung Tonic.**—*Balsam of Tolu, Oil of Aniseed and Oil of Cloves.—L. ii.*/03,1493. *Does not contain poison.—L. ii.*/06.1390.

*The alkaloids of Ipecacuanha were found to the amount of* 0·002%. *If present in the form of Wine of the official strength this represents Ipecacuanha Wine* 15 *m., Chloroform* 2 *m. in each ounce.—B.M.J. ii.*/ 08,1698.

✶**Oxien.**—*Powdered Sugar, Starch and Gaultheria Oil.—L. ii.*/03,1493.

✶**Oxien Medi-Cone Pile Treatment.**—*The suppositories weigh on average* 19 *grains. Analysis showed Lead Acetate* 5·6, *Creosote about* 2: *Resinoid substance* 3 (*showing presence of Tannin*), *vegetable tissue* 1, *Hard Paraffin* 7, *Theobroma Oil* 81·1%.—*B.M.J. ii*/08,87.

**Oxygar.**—*B.M.J. i.*/10,762.

✶**Ozerine** (*in epilepsy*).—*Potassium Bromide, Ammonium Iodide with Chloroform Water.—L. ii.*/03,1493; *B.M.J. ii*/04, 1586, *gives approximately Potassium Bromide,* 120 *grains, Ammonium Carbonate* 16 *grains per ounce (without Iodide), with Chloroform Water, &c*

**Ozonia.**—*Analysis showed the composition of the salt to be: Sodium Carbonate (reckoned as anhydrous) 77.00, Water 22.30, Chloride (reckoned as Sodium Chloride) 0.46%, Potassium Salt a trace.—B.M.J. i./10,393.*

**✶Paciderma Crème.**—*Zinc Oxide, Calcium Carbonate, Calcium Sulphate. Boric Acid and Basis.—B.M.J. i./08,943. q.v. also for Powder and Blood Wafers,*

**✶Page-Woodcock's Wind Pills.**—*Aloes, Caraway Oil and Soap.—L. ii./03,1493; B.M.J. i./11,1326 gives the following, freed from coating the pills had an average weight of 1.6 grains. Evidence of the presence of Aloes (Barbados) or a preparation of aloes, a little Ginger, a little Soap, a trace of Capsicum and Oils of Peppermint and Cinnamon, and some indistinguishable vegetable tissue.*

**Panopeptone.**—*100 contained Alcohol 20, Total Solids 26·9, Nitrogen 1·14 (equivalent to Protein 7·2), Ash 1·1, Sugar 7·8.—B.M.J. ii./09,562.*

*May be dispensed by registered chemists under certain conditions. Vol.I.,p.602.*

**Parr's Life Pills.**—*Aloes, Rhubarb, Jalap, Gentian, Clove Oil.—Murrell.*

**Patterson's (Dr.) Female Pills.**—*Freed from coating the pills had an average weight of 3.2 grains. They contained Sulphate of Iron, Barbadoes Aloes, Soap, Powdered Ginger, Cardamom and Cinnamon.—B.M.J. ii./11,35.*

**Pelloids,** *see Stafford-Brookes'.*

**✶Peps.**—*B.M.J. ii./11,1543, summarises results of analysis (q.v. for further details) thus: Sugar about 70%, Extract of Liquorice about 25%, Resinous matter 0.7%, Oil of Peppermint a trace, Oil of Anise a trace, Talc about 4%.*

**✶Perry-Davis' Pain Killer.**—*Spirit of Camphor, Tincture of Capsicum, Tincture of Myrrh and Alcohol.—Murrell.*

**Pfefferman's Carbonic Acid Compress.**—*The Packet contains a tube of 20 Gm. of soft white paste, which consists of about 30 parts Sodium Carbonate, 15 parts of Magnesium Carbonate, 10 parts of Soda Soap, 5 parts of Menthol and 40 parts water; also a small square of lint impregnated with Tartaric Acid. and a piece of protective.—B.M.J. ii./08,204.*

**✶Phatolene Tablets.** *Analysis showed these ovoid pills of average weight 2.7 grains to consist of Ext. Fuci Vesiculosi with about 10% Powdered Liquorice root.—B.M.J. i./11,824.*

**✶Phelps Brown's Vervain Restorative.**—*Decoction of Vervain (2 ozs. to a pint) 4 drachms, Port Wine 1 drachm, Alcohol 2 drachms, Water to 1 ounce. Dose.—2 drachms. Is 25% alcohol.—B.M.J. ii./04.1585.* **Phelps Brown's Blood Purifier.** *Nothing in particular found beyond 23% Alcohol.—B.M.J. ii./07,531.*

**✶Phosferine.**—*Analysis showed Quinine Sulphate 0.67, Diluted Sulphuric Acid 2.5 parts, Diluted Phosphoric Acid 54.6, Alcohol 8.1, Water to 100 parts.—B.M.J. i./11 26.*

**Pink Pills.**—*Iron Sulphate, an alkaline carbonate, and Liquorice thickly coated with sugar and coloured with carmine.—L. ii./03,1493. See also Williams' Pink Pills.*

**Pinkham's (Mrs. Lydia E.) Vegetable Compound.**—*Analysis showed it to contain Alcohol 19.3% and Solid Matter 0.6%, traces of Tannin, Ammonia, and Reducing Sugar, also traces of a bitter substance soluble in Ether.—B.M.J. ii./11,33.*

**Plant's Cigarettes** (*For Asthma.*)—*Leaves of Stramonium, Lobelia, and Green Tea.—L. ii./03,1493.*

**Pond's Arthriticus.**—*Analysis of the liquid showed the mixture to have the following composition in one dose approximately: Lithium Citrate 5.0, Potassium Citrate 3.0, Sodium Citrate 0.7, Sodium Salicylate 5.3, Potassium Bromide 5.6, Potassium Bicarbonate 28.0, Glycerin 18.0 grains, in Dilute Chloroform Water. Analysis of the powder to be taken with the mixture showed an average of 14.2 grains of Tartaric Acid per dose.—B.M.J. ii./10,984.*

**✶Poslam.**—*Analysis showed approximately Zinc Oxide 12, Flowers of Sulphur 8, Maize Starch 18, Salicylic Acid 1.5, Oil of Cade (?) 1.5, Oil of Birch Tar 8, Anhydrous Lanoline 25.5, Soft Paraffin 25.5%.—B.M.J. ii./10,1353.*

**✶Powell's Balsam of Aniseed.**—*Does not contain poison.—L. ii./06,1390 Contained inter alia (v.B.M.J.) Benzoic Acid and 0·012% of alkaloid—possibly a Morphine derivative. Evidence in the past has been brought showing this preparation to contain Morphine. Composition has been changed since then.—B.M.J. ii./08,1698.*

*The Manufacturers inform us it contains no ingredient coming within* Ⓢ *or* Ⓟ.

**Powell's. Nurse, Remedies for Ladies.**—*Sanol Cones = Iron, and Quinine, and Gentian in Cacao Butter basis, &c.—B.M.J. ii./07,1656, q.v. for others of Nurse Powell's preparations.*

**Pritchard's Teething and Fever Powders.**—*Dose on lines of Stedman's v. infra. Average weight* 2·1 *grains. Consist of Calomel* 47, *Antimony Oxide* 0·7, *Calcium Phosphate* 1·4, *Milk Sugar* 50·9%.—*B.M.J. ii.*/08,1022.

**Quina Wine.**—*Alcohol* 16·9%, *Glucose* 22·2%, *Alkaloid Cinchona* (0·05) "*Two measures*" *represent about* 10, *to* 15 *minims Liquid Extract of Cinchona.*—*B.M.J. i.*/09,1308.

**Radio-Vimettes (Dr. Morgan's).**—*Analysis showed Reduced Iron* 70, *Quinine Sulphate* 11.8, *Phosphorus* 0.13%. *In one pill Reduced Iron* 2.6 *grains, Quinine Sulphate* 0.44 *grain, Phosphorus* 0.005 *grain.*—*B.M.J. i.*/11,91.

**Radium Salve.**—*The* α *radioactivity is about* $\frac{1}{100}$ *part of that of uranium. The* β-*radiation is too feeble to be detected by a sensitive electroscope.*—*B.M.J. i.*/09,1128.

**Ray's Pills (Dr.)**—*Consist chiefly of Aloes and a small quantity of Soda Soap* (*see also Nerrol*).—*B.M.J. ii.*/08,204.

**★Red Cross Pills.**—*Freed from coating the pills had an average weight of* 2.6 *grains. Analysis showed Resin* 24.3 *apparently Copaiba Resin, a small quantity of Oil of Copaiba, Magnesia* 8%, *Liquorice and Starch. No other active ingredients were found.*—*B.M.J. ii.*/11,78.

**Renascin.**—*Tablets containing chiefly the Chlorides, Phosphates and Sulphates of Potassium, Sodium, Magnesium, Calcium, Manganese and albuminous compounds of Iron and Manganese with traces of Lecithin.*—*B.M.J. ii.*/08,204.

**Rheumsol Bath Salts.**—*Analysis showed the Salt to consist of Sodium Carbonate* (*reckoned as anhydrous*) 87·96%, *Water* 11·18% *chloride, considerable trace, Potassium Salt trace.*—*B.M.J. i.*/10,393.

**★Rhycol Treatment.**—*Tampons, for nasal use in an inspirator, on extraction with a suitable solvent yielded a small quantity of volatile oil, the average quantity being* $\frac{1}{5}$ *minim. This had the odour of a mixture of oil of eucalyptus and essential oil of camphor with a little terebene and a trace of oil of wintergreen.*

*The Lubricant consists of soft paraffin with the addition of a very small quantity of carbolic acid.*

*The Antiseptic consists of a solution of Formaldehyde.*—*B.M.J. ii.*/11,1545.

**★Rice's Treatment for Rupture.**—*An appliance and 'Lymphol.' Careful comparison indicated following for the 'Lymphol.' Tincture of Capsicum made with strong Alcohol* 60, *Oil of Origanum* 6, *Oil of Peppermint* 1, *Oil of Spearmint* 0·3, *Red Dye, q.s. Rectified Spirit to* 100.—*B.M.J. ii.*/08,1193.

**Richter's (Dr.) Orudon Essence.**—*B.M.J. i.*/10,762.

**★Roche's Embrocation.**—*Olive Oil, Oil of Amber, Oil of Cloves, and Oil of Lemons.*—*Murrell.*

**Rollo's Remedy for Piles.**—99% *of fatty basis—all ordinary medicinal substances were absent.*—*B.M.J. ii.*/08,88.

**Ruspini's Styptic.**—*A strong solution of Gallic Acid and Spirit of Roses, with perhaps a little Zinc Sulphate.*—*Murrell.*

**Russell's Anti-Corpulent Preparation.**—*Citric Acid* (*about* 20 *grs. to* ½ *oz. a dose*), *with Water, and a little Iron. The Pink Tablet = Saccharin.*—*L. ii.*/03,1493; *B.M.J. ii.*/07,25.

**★Sacco,** *also called* **Lungsalva,** *consists of Alcohol, glycerin, and a solid substance identical in its characteristics with Krameria.*—*B.M.J. ii.*/10,563.

**★St. Raphael Tonic Wine—"Quinquina."**—*Alcohol* 16·89, *Glucose* 11·8, *Alkaloid* (*Cinchona*) 0·008. *A wine-glassful = about* 1½ *m. of Liquid Extract of Cinchona.*—*B.M.J. i.*/09,1308.

**★St. Raphael's Tannin Wine.**—*Alcohol* 14·65, *Glucose* 14·0, *Tannin* (*as in ordinary Port Wine*), *Alkaloid a trace.*—*B.M.J. i.*/09,1309.

**Sargol**—'*A Flesh Producer.*' *Analysis of the Tablets* (*average weight* 5·3 *grains*) *showed Zinc Phosphide* 0.7, *Lecithin* 1.9, *Calcium Hypophosphite* 12.9, *Sodium and Potassium Hypophosphites* 7.7, *Albumen* (*Soluble*) 4.2, *Insoluble Protein* (*? Coagulated Albumen*) 10.8, *Sugar* 18%.—B.M.J. i./12,846.

**★Savar's Coca Wine.**—*Alcohol* 23.4%, *Glycerin* 6·1%, *Glucose* 2·6, *Alkaloid* (*Coca*) 0·07%. *Dessertspoonful = about* 21 *minims of Liquid Extract of Coca.*—*B.M.J. i.*/09,1307.

**Schaeferts** (*Dr. J.*) *physiological nutrient* (*nerve*) *salts for neurasthenia consists of glycerophosphate of Calcium* 40 *parts, Glycerophosphate of Sodium* 30 *parts and* 20 *parts of Sodium chloride with a trace of iron.*—*Deut. Med. Woch., Sept* 5/10.—*Ex. B.M.J. ii.*/10,1900.

**Scott's Pills.**—*Average weight* 2.4 *grs. Examination indicated small quantity of Aloes, Ginger, Rhubarb and Soap.—B.M.J. i.*/11,1326.

**Scott's Emulsion** *is stated to have the following composition: Cod-liver Oil* 40 *litres; Glycerin,* 19·875 *kilos; Solution of Calcium Hypophosphite* 0·8 *per cent.,* 20·450 *kilos; Solution of Sodium Hypophosphite* 0·4 *per cent.,* 20·150 *kilos; Flavouring Essences,* 2·970 *kilos; Gum,* 650 *Gm.—Ph. Notes.*

**Seeger's Hair Dye.**—*W.* (*Brown*) *Pyrogallic Acid* 3·8%, *Cupric Chloride* (*anhydrous*) 1·8%, *Hydrochloric Acid* (*B.P.*) 0·7%, *Sulphuric Acid* 0·07%.—*B.M.J. i.*/10,152.

**✶Seigel's (Mother) Syrup.**—

*Quantitative determination indicated—*

*Dilute Hydrochloric Acid* (*B.P.*) 10 *parts by measure, Tincture of Capsicum* 1.7 *ditto, Aloes* 2 *parts, Treacle* 60 *parts, Water to* 100 *by measure.—B.M.J. i.*/09, 33.

*Correspondence between a doctor and the proprietors.—B.M.J. i.*/11,572.

**Serravallo's Tonic Bark and Iron Wine.**—*Alcohol* 17·26%, *Glucose* 6·3, *Cane Sugar* 12·2, *Iron* 0·01, *Alkaloid* (*Cinchona*) 0·05, *Liqueur glass represents about* 3 *minims of Liquid Extract of Cinchona.—B.M.J. i.*/09,1308.

**Serum Bantier, "Anti-gonococcide"** *is not a serum, but a Solution of Magnesium-iodo-phenol Sulphonate.—L. ii.*/08,104.

**✶Sequarine.**—*The liquid contained Alcohol* 35.8%, *Oil of Peppermint a trace; on evaporation it left* 1.9 *per cent. solid residue of which* 0.6 *was ash,—principally Sodium and Potassium Phosphates. Nitrogen present* 0.22 *per cent.* = *to* 1.4% *of Protein, small portion present as Ammonia, perhaps formed by decomposition of nitrogenous organic matter. Definite constituents could not, of course, be isolated.—B.M.J. i.*/11,27.

**✶Sexualine** *see* **Vital Sexualine.**

**Seymour (Mrs.) Treatment.**—*Obesity. Contained Starch, an extract probably Fucus vesiculosus, Boric Acid and possibly a trace of thyroid.—B.M.J. i.*/11,836.

**Shadeine** (*Brown*).—*Pyrogallic acid* 2·1% *Cupric Chloride* (*anhydrous*) 1·3% *Hydrochloric acid* (*B.P.*) 0·3%.—*B.M.J. i.*/10,152.

**Shaffer Bennyon's Mrs. Remedy**—*The suppositories had an average weight of* 14.2 *grains and showed on analysis the following composition: Quinine Sulphate* 5.1, *Boric acid* 4.9, *Oil of Theobroma* 90%, *and a trace of Oil of Rue.—B.M.J. ii.*/11,32.

**Singleton's Eye Ointment.**—*Analysis showed principal ingredient the Red Mercuric Oxide* 7·4, *Fatty basis contained inter alia about* 4% *beeswax.—Secret Remedies.*

**Stafford-Brookes' (Mrs.) Pelloids.** — *The pessaries had an average weight of* 14.2 *grains, analysis showed them to contain Boric Acid* 2.3%, *Quinine a trace, coloured pink with alkanet.—BM.J. i.*/11,33.

**✶Standard Malt Extract and Cod Liver Oil.**—*Stated to contain* 25% *Oil. Analysis showed Oil* 4.1%, *Reducing Sugar* (*as Maltose*) 64%, *Protein* 5.9, *Diastatic Power* 74.—*B.M.J. i.*/10,30.

**✶ Stearn's Headache Cure.**—*Powders each contained Acetanilide* 3·92 *grains, Caffeine* 0·98 *grain, Milk Sugar* 4·9 *grains.—B.M.J. ii.*/06,27.

**Stedman's Teething Powders.**—*Average weight* 2·4 *grains. For a child under* 3 *months the third of a powder; from* 3 *to* 6 *months* ½ *a powder; when above* 6 *months a whole powder. The powder consists of Calomel* 29% *and Sugar of Milk* 71%. *A trace of alkaloids* (*not identified*) *B.M.J. ii.*/08,1022.

**✶Steedman's Soothing Powders.**—*Calomel and Starch.—L. ii.*/03,1493. *Average weight* 2·8 *grains each. Consisted of Calomel* 27, *Sugar* 22, *Maize Starch* 50·5, *Ash* 0·5%. *Directions similar to Stedman's above.—B.M.J. ii.*/08,1022.

**Stevens' Consumption Cure.**—*Formula appears to be approximately Rectified Spirit of Wine* 23·7 *parts by measure, Glycerin* 1·8 *parts, Decoction of Krameria* 1 *in* 3 *to* 100 *parts by measure, or it may be made with Tincture of Krameria.—B.M.J. ii.*/08,506. *See also ibid i.*/09,672.

**Stomagen.**—*Light brown powder containing* 5% *Bismuth Subnitrate, Pepsin, Milk Sugar, Condurango Bark, Angustura Bark and Ginger.—B,M.J. ii.*/08,204.

**✶Sulpholine Lotion.**—*Analysis showed Sulphur. precip.,* 3, *Zinc Oxide* 2.1, *Calcium Sulphate* 0.6, *Glycerin* 9, *Strong Rose Water to* 100 *parts by measure.—B.M.J. ii.*/10,1352.

**✶Swamp-Root, Kilmer's.** *see Kilmer's.*

**Tablones and Tablenes.**—*see Mother's Advice.*

**Tatcho.**—*Borax* 2·7%, *Glycerin* 2·5%, *Quinine* 0·006%, *Formaldehyde Solution* (40%) 0·38%, *colouring and perfume a trace, Alcohol* 2·4%, *Water to* 100, *by volume,* —*B.M.J.* i./10,151.

**Taylor's Anti-Epileptic Medicine.**—*Formula ascertained was Tincture of Iodine* ¾ *m., Potassium Bromide* 13 *grains, Ammonium Bromide* 4 *grains, Water to* 1 *ounce. Dose,*—1 *teaspoonful thrice daily.—Secret Remedies.*

**Teetolia Treatment.**—29·3% *by volume Alcohol,* 2·3% *Alkaloid principally Quinine.—B.M.J. i.*/09,911.

**Temperancia Association Treatment.** (*For inebriety*).—*Capsules containing approximately* 8 *grains of powder. Analysis showed presence of powdered Cinchona, Sugar of Milk and Magnesium Carbonate.—B.M.J. i.*/12, 141.

**Terry's, (Mrs.,) Drink Cure.**—*Sugar* 98% *and Sodium Chloride* 2%. —*L. ii.*/03,1493.

✶**Therapion No. 3.**—*Results indicated Camphor* 2·5, *Glycerin* 24, *Powdered Liquorice* 40, *Calcium Glycerophosphate* 1·8, *Extract of Gentian* 5, *Extract of Damiana* (?) 8, *Alkaloid* 0·06, *Water to* 100.—*B.M.J. i.*/09,32.

*The Manufacturers inform us ' non-poisonous.'*

**Tissander's** (*Professor*) **cure for rheumatism,** *gout, and sciatica tablets. Examination showed sulphur, salts (chiefly alkali phosphates) and an emodin —containing vegetable powder (rhubarb, senna).—Deut. Med. Woch. Sept.* 13/10, *per B.M.J. ii.*/10,1900 .

**Toris Root Compound.**—*Contains Sodium Salicylate, Potassium Nitrate and Sugar.—L. ii.*/08,104.

✶**Townsend's, Old Dr. Jacob, American Sarsaparilla** *is similar to the official Liquor Sarsæ Comp. Conc., but without Liquorice and with addition of Sugar.—B.M.J. ii.*/07,530.

✶ ***Towle's Pennyroyal and Steel Pills.**— *Contain about* 14 *grains Dried Iron Sulphate, Capsicum* 86 *grains, Pennyroyal Oil* 3 *minims,excipient q.s.,—in* 100 *pills.—B.M.J. ii.*/07,1653.

✶ **Tremol Blood Mixture.**—*A mixture prepared according to the following formula agrees very well in regard to the vegetable drug and perfectly in other respects. Calcium Chloride* 224 *grains, Solution of Ferric Chloride* 300 *minims. Dilute Hydrochloric Acid* 200 *minims, Concentrated Infusion of Rhubarb* (1—7) 100 *minims, Peppermint Water* 2 *ounces, Water to* 8 *ounces.* —*B.M.J.*/i.10,1064.

✶**Tremol Lotion.**—*Analysis showed the liquid to consist of solution of chlorinated soda containing* 2·9% *of available chlorine.—B.M.J. i.*/10,1064.

✶ **Tremol Ointment.**—*Analysis showed the ointment to contain Prepared Chalk* 70·3 *parts, Soft Paraffin* 29·0 *parts, Yellowish brown colouring matter* (? *a coal-tar dye*) *traces.—B.M.J. i.*/10,1064.

✶ **Tremol Ointment No. 2.**—*The quantities of the different ingredients were determined, and the results agreed with the following formula : Zinc oxide* 9.8, *Lead Carbonate* 3.5, *Sodium Benzoate* 0.3, *Sodium Acetate* 0.7, *Water* 9.6, *colouring matter* (*Pink, evidently a coal-tar dye*) *traces,Lard to* 100 *parts.—B.M.J.* i./10,1064.

**Trench's Remedy for Epilepsy.**—*Contains about* 9 *grs. Potassium and* 1 *grain Ammon. Bromide (concentrated form is* 15 *grains Potass. Brom. in a powder for a dose).—B.M.J. ii.*/04,1586.

**Trommer's Elixir.**—*Stated to contain the active enzymes of Malt, Glycerophosphates, and what is described as the "alkaloidal" extractive of Cod livers.— L. i.*/10,653.

**Trommer's Malt Extract and Cod Liver Oil.**—*Oil* 29·9%. *Reducing Sugars (as Maltose)* 41·4%, *Proteid* 2·4%, *Diastatic Power* 35,—*B.M.J. i.*/10,30.

✶**Trilene Tablets** (*For Obesity.*)—*Sugar and a vegetable constituent of unknown nature.—L. ii.*/03,1493. *Minute quantity of Fucus amongst other ingredients,* 87% *Sugar.—B.M.J. ii.*/07,209.

✶**Tuberculozyne,** (*Derk P. Yunkerman Co.*) *No.* I. *Potassium Bromide* 3·4, *Glycerin* 12·0, *Cassia Oil* 0·1, *Tincture of Capsicum* 0·17, *Cochineal Colouring q.s. Caustic Soda* 0·06. *Water to* 100 *gave an exactly similar liquid.*

*No.* II. *Glycerin* 18, *Essential Oil of Almonds* 0·1, *Burnt Sugar q.s., Water to* 100 *fluid gave an exactly similar liquid.—B.M.J. ii,*/08,508.

Bernard Dyer stated the remedy, from analysis of the two samples supplied, consisted chiefly of glycerin flavoured with cinnamon in one sample and almond in the other. One was slightly alkaline and contained phosphates and potassium, the other was slightly acid with minute traces of copper. He understood the solutions were mixed before taking, and said that the amount of copper taken per day would be about $\frac{1}{100}$ grain. The cost of the treatment was stated to be £2.—C.D. ii./08,220.

Ⓟ ✶**Tucker's Asthma Cure.**—*According to Dr. Wilcox, Home Office Analyst, in the action against the "Lancet," January* 1908, *this contains Cocaine* 2·28 *grains, Atropine* 0·87 *grain, Sodium Nitrite* 15·25 *grs. per ounce,* 20-30% *Glycerin and a trace of Balsam or Benzoin.*

*A solution of Cocaine Nitrite* 1·028, *Atropine Nitrite* 0·581 *in Glycerin* 32·16 *and Water to* 100 *is said to produce good results when used in an atomiser. The Nitrites in question are not very stable salts.*

*Another analysis says Atropine Sulph.* 0·15, *Sodii Nitris* 0·6, *Glycerin* 2·0, *Water* 15·00.—*B.M.J.E. i.*/09.43.

Vasey, for the "*Lancet,*" found *in one sample* Cocaine 1·03 grains, Atropine 0·52 grains, Sodium Nitrite 16 grains; in another, Cocaine 1·47 grains, Atropine 0·66 grains, Sodium Nitrite 24·46 grains.—C.D. i./08,112; B.C.D. i./08,73, *c.f.* also L. ii./03,1493.

The alkaloids in such a mixture may be determined by means of Platinic Chloride and estimating the Nitrogen in the precipitate,—then differentiating Cocaine from Atropine by precipitation with Potassium Dichromate Solution in strong Hydrochloric Acid.

Another method would be to soak up the fluid in a paste of Lead Oxide and Magnesium Oxide, extract repeatedly with Chloroform, filter, evaporate to dryness, weigh total Alkaloids, then titrate with N/100 Acid (using Phenolphthalein); this gives the amount of Atropine; finally titrate with Methyl Orange, which gives Cocaine.

**Uricura Drops** and **Liniment.**—*In the case of the Drops, the approximate formula arrived at by analytical methods was :—Oil of Amber* 5, *Terebe* 47.5, *Oil of Turpentine* 47·5%. *In the case of the Liniment the formula arrive at was as follows :—Oil of Turpentine* 42.0, *Acetic Acid* (*B.P.*) 10.0, *Stron Solution of Ammonia* 2.3, *Alcohol* 9.0, *Egg Substance* 2.0, *Alkaloid* (?) 0.01, *Water to* 100 *parts* (*all by measure*).—*B.M.J. ii.*/10 982.

**Van Vleck's (Dr.) Absorptive Plasma.**—*Formula approximately Powdered galls,* 6 *parts, Menthol* 1 *part, Crude Petroleum Jelly to* 100 *parts.* **Ditt Food Cones** *weigh* 21 *grains. Analysis showed wheat flour* 28, *Oil of Theobrom* 68%, *Water* 4%, **Van Vleck's Pile Pills.**—*Analysis showed small quantitie of Powdered Capsicum, Powdered Liquorice, and Maize Starch, and other ingredients For further information, vide B.M.J. ii.*/08,88, 89.

**Van Vleck's Catarrh Balm.**—*Analytical results gave formula : Phenol* 0·6 *Sandal Wood Oil* 0·5. *Oil of Pumilio Pine* 0·7, *Eucalyptus Oil* 1·2, *Soft Paraffin t* 100.—*B.M.J. ii.*/08,1283.

✶**Vana.**—*Alcohol* 19·2, *Glucose* 20·0, *Alkaloid* (*cinchona*) 0·23, *Calcium* 0.01 *Phosphorus* (*combined*) *as Phosphoric Acid* 0·13. *A wineglassful = about* 3 *minim of Cinchona Extract* (*Liq.*).—*B.M.J. i.*/09,1308.

**Varalettes (Bishop's Gout)** *showed presence of Lithium Citrate and mall quantity of what appeared to be piperazine with the usual effervescing basis —'Secret Remedies.'*

Ⓟ **Vars, Dr., Kidney Pills** (*Flexible Capsules*) *contain inter alia Peppermint Oil, Juniper Oil, Potass. Nit., Powdered Squill, Henbane and Taraxacu Extract.*—*B.M.J. ii.*/06,1646.

**Veno's Lightning Cough Cure.**—*Analysis showed inter alia* (*vide ref.* 0·23% *resin, resembling that of Grindelia robusta. It is alkaline, so is the Liqui Extract of Grindelia, I. C. Add.*—*B.M.J. ii.*/08,1699.

**Veno's Seaweed Tonic.**—*The following almost identical: Leptandrin* 1 *gr. Sodium Phosphate* 33 *gr., Liquid Extract of Cascara* 45 *minims, Conc. Inf Rhubarb* (1 *to* 7) 1 *dr., Conc. Inf. of Senna* (1 *to* 7) 2½ *dr., Water, &c.,* to 3 *ounce Dose,* 1 *drachm.*—*B.M.J. i.*/07,213.

**Verophen Mouth Water.**—*Consists of a* 0.2% *solution of Chinos in water.*—*Deut. Med. Woch, Sept.* 15/10, *per B.M.J. ii.*/10,1900.

✶**Vibrona.**—*Alcohol* 19·30%, *Glucose* 6·4, *Cane Sugar* 5·2, *Alkaloid* (*Cinchon Alkaloids, less Quinine and Cinchonidine*) 0·02.—*B.M.J.* i./09,1308. *Slight revisio of statement.*—*B.M.J. i.*/09,1491.

**Victoria Asthma Drops.**—*B.M.J. i./10,762.*

**Vigoral.** — *Total Solids* 50·8, *Nitrogen* 3·8 (*equivalent to Protein* 24·0), *Ash* 16·0%.—*B.M.J. ii./09,563.*

**Vigoroids** *see* **Lecoy's.**

**Vilixir,**—(*Liquid*).—*Sulphur precipitated* 3·2%, *Lead Acetate* 1·8%, *Glycerin* 5·7%, *Rosewater to* 100 *by volume.* **Shampoo Powder**: *Borax* 4·6, *Powdered Soap* 24·4, *Sodium Carbonate* (*partly exsiccated*) 71·0%.—*B.M.J. i./10,152.*

**Vincent's (Dr.) Anti-Stout Pills.**—*Evidence was obtained that they contained Jalap, Colocynth, Cloves, Aloes, or Extract of Aloes, Extract of Fucus Vesiculosus.—B.M.J. i./11,823.*

**Vin Regno (Pearson's Liebig's Beef Wine).**—*A wineglassful* (2 *ounces*), *contain alcohol* 2.5 *drachms, Meat Extract* 2.6 *grains, Glucose* 65 *grains* (*Quinine not identified*).—*B.M.J. i./09,796.*

**Vin Urané Pesqui.**—*Analysis showed inter alia in* 100 *parts by measure Alcohol* 8·75, *Glycerin* 3·55, *Total Solids* 2·92, *Uranium equivalent to Crystalline Nitrate* 0·02 (=1/12 *grain in fluid ounce, or* ½ *grain in the daily dose*).—*B.M.J. ii./08,* 1875.

**Vinsip (Liquor Hæmoglobin Co.).** — *Alcohol* 8.6, *Total Solids* 20·2, *Nitrogen* 2·9 (=*Protein* 18·2), *Ash* 1·0 *in* 100 *fluid*).—*B.M.J. ii/09,562.*

✶**Virol.**—*Analysis showed it to contain Fat* 12·3%, *Reducing Sugars* (*as Maltcos*, 59%), *Diastatic power nil.*—*B.M.J. i./10,29.*

**Visnervin.**—*Sugar, Chocolate-Coated Pastils weighing about* 1 *Gm., consist chiefly of flour, sugar, vanilla, and albumens.—B.M.J. ii./08,204.*

✶**Vitæ-Ore.**—*According to analysis each dose would contain Ferric Oxysulphate* 0.47 *grain and Magnesium Sulphate Anhydrous* 0.15 *grain.—B.M.J. i./11* 27.

✶**Vital Sexualine.**—*Restorative, Gordon's.—Analysis showed Iron Hypophosphite* 0.50, *Calcium Hypophosphite* 0.50, *Sodium Hypophosphite* 0.60, *Potassium Hypophosphite* 0.14 *Quinine Sulphate* 0.50 *Citric Acid* 0.90 *Sugar* 51, *Glycerin* 36 *by measure, Colouring Matter q.s. Water to* 100 *by measure.* — *B.M.J. i./11,93.*

**Völlner's, J., Rheumatism Cotton Wool.**—*Ordinary raw Cotton Wool.* —*B.M.J. i./10* 762.

**Wallace's Twelve Specific Remedies.**—No. II. *Analysis showed Berberine* 0.05, *Hydrastine* 0.11, *Alcohol* 32.3 *by volume, Extractive* 2.7, *Ash* 0.3. *No. III. Analysis showed Caffeine* 0.25, *Cane Sugar* 1.7, *Glucose* 0.6, *Ash* 0.52, *Alcohol* 47.25 *by volume, Extractive,* 3.13%. *A Tincture of pale roasted coffee* (1 *to* 5) *appeared to be identical. No. V., Alcohol* 30.5 *by volume, Ash* 0.2, *Reducing Sugars* 2.9, *Extractive* 1.7. *No. VII., Alcohol* 51.05, *Ash* 0.22, *Reducing Sugar* 1.0, *Fat and Extractive* 2.1. *A Tincture of Nutmeg* (1 *to* 5) *was found to agree in all respects. No. X., Alcohol* 26.6, *Ash* 0.38, *Reducing Sugars* 0.55, *Extractive* 1.27. *Very like weak Arnica Tincture. No. XI., Caffeine* 0.1, *Sugars* (*chiefly cane sugar*) 0.7, *Ash* 0.26, *Alcohol* 51.05, *Extractive* 2.1. *On same lines as No.* III.—*B.M.J. i./11,147.*

**Wallace's, Gordon, "Treatment."**—*Obesity. Freed from coating the Tablets had an average weight of* 2.9 *grains. Analysis showed them to consist of an extract agreeing with Fucus Vesiculosus Extract* 2 *grains, and a vegetable powder, probably Liquorice Powder.—B.M.J. i./11,823.*

✶**Warner's Safe Cure.**—*Potassium Nitrate* (*about* 10 *grains to the ounce*) *and various diuretic herbs.—L. ii./03,1493. A mixture made with Potassium Nitrate* 50 *grains Alcohol* 5 *drachms, Gaultheria Oil* ⅓ *minim, Liquid Extract of Taraxacum* 10 *drachms, Glycerin* 4 *drachms, and Water to* 8 *ounces is almost Identical.* —*B.M.J. i./07,213. An Extract of Liverwort Leaves,* 30. *Nitre* 15 *Glycerin* 45, *Alcohol* 60, *with some Wintergreen Oil.* **Pills,**—*Aloes, Soap, Marsh Mallow, and Liquorice.—B.M.J. ii./08,1377.*

*See also formula presented to German Government authorities by manufacturer.—M.P., Sept.* 29./09,347.

**Weidhaas Hygienic Institute.**—*See B.M J. i./09,824.*

✶**Welch's Female Pills** (*Kearsley's original Widow Welch's Female Pills*).—*Contain Iron Sulphate, Sulphur, Liquorice, Turmeric with excipient.—B.M.J. ii./07,1654.*

**Whelpton's Purifying Pills.**—*Weight* 2½ *grains. Chemical examination showed Aloes* (*apparently Socotrine*), *Powdered Colocynth, Ginger and Gentian. No evidence of Mercury or Calomel.—B.M.J. i./11,1326.*

**White's (Dr.) Kompo.**—*The following formula gave a mixture scarcely distinguishable from the original by either physical or chemical means. Eucalyptus Gum (red gum)* 1.5, *Caustic Soda* 0.08 *(used for darkening the colour, also indication that burnt sugar was used for this purpose), Oil of Cinnamon (or Cassia)* 0.25, *Oil of Cloves* 0.25, *Tincture of Capsicum* 7.5, *Salicylic Acid* 0.07, *Rectified Spirit* 1.5, *Decoction of Cinnamon and Cloves (5 parts of each in 200 of Water boiled to half volume) to* 100.—*B.M.J. ii./*11,1544.

***Williams' (Dr) Pink Pills for Pale People.**—*Contain Potassium Carbonate, Iron Sulphate and traces of Manganese Oxide and ' Neuræmin ' (supposed to be a combination (?) of lecithin, hæmatin and smilacin) ; the last is from Sarsaparilla ; also a substance containing Emodin. Some Arsenic is contained in some.—B.M.J. i./*07,879.

*The quantities found indicated following formula—exsiccated Sulphate of Iron* 0.75 *grain, Potassium Carbonate* 0.66, *Magnesia* 0.09, *Powdered Liquorice* 1.4. *Sugar* 0.2, *in one pill.—B.M.J. i./*09,32. *So also B.M.J. i./*10,213.—*Formula may have been altered.*

**Wilson's Patent Ringworm Cure.** *See 'Dethblo'.*

**Wincarnis,** *see* **Coleman's.**

***Winslow's, Mrs., Soothing Syrup.**—*Previously contained poison, but in November,* 1909, *was altered—does not come within provisions of Poisons and Pharmacy Act,* 1908.

*Analysis showed it to contain in* 100 *parts by measure, Potassium Bromide* 2.0, *Alcohol* 4.3 *parts by measure, Essential Oil (Anise) about* 0.1 *part, Sugar* 56.5 *parts. Emodin was present in small quantity, a Syrup containing* 1.2% *by measure of the Syrup of Senna (Off.), agreed in several respects.—B.M.J. i./*12,683.

**Woodcock's Pills,** *see* **Page Woodcock's.**

Ⓟ **Woodcock's Cough Pills** *are stated to contain Morphine.*

Ⓢ **Woods, Edward J., Treatment** *(Inebriety).—Powders,—Analysis showed contained Tartar Emetic* 3.6. *Sugar of Milk* 96.4%. *A powder of average weight would contain* 0.35 *grain Tartar Emetic.* Ⓢ *Tablets,—Tartar Emetic* 13.2, *Boric Acid* 10.7, *Sugar of Milk* 76.1%. *One would contain* 0.2 *grain Tartar Emetic.—No trace of any other substance was found in either the Powders or Tablets.—B.M.J. i./*12,142.

**Woodward's Gripe Water.**—*Analysis showed in* 100 *parts by measure, Sodium Bicarbonate* 1.08, *Essential Oil about* 0.03, *Alcohol* 3.8 *parts by measure, Sugar* 20.5. *The Essential Oil appeared to be chiefly Oil of Caraway, with a little Oil of Dill, and possibly also of Anise.—B.M.J. i./*12,683.

**Yonkerman.**—*See* **Tuberculozyne.**

***Zam-Buk.**—*Eucalyptus Oil* 14%, *Pale Resin (Colophony)* 20%, *Soft Paraffin* 55%, *Hard Paraffin* 11%, *Green colouring matter, a trace.—B.M.J. i./*08,944.

***Zip Ointment.**—*Calomel, Lead Acetate, Lead Oleate, Oil (probably Olive), Creosote, Oil of Lemon Grass, Paraffin Ointment.—B.M.J. i./*08,944.

***Zotos.**—*Capsules (sea sickness preventive), contained* 6.3 *grains, pinkish powder consisting of* 76.9% *Chlorbutol (Syn. Chloretone), and* 23% *Lactose.—B.M.J. ii./*09,1419.

***Zox Powders.**—*Average weight* 4½ *grains. Consists of Acetanilide only.—B.M.J. ii./*08,1112.

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# ANIMAL ORGANOTHERAPY

## LIQUOR THYROIDEI.

*Assay,*—The author suggests as standard 0.025 Gm. Iodine in organic combination in 100 Cc. of Liquor—this being based on an average content in the fresh gland of 0.04%, the weight of the gland as at least 60 grains. The method of estimation should be to employ 10 Cc. of the Liquor and determine Iodine content on the lines of the process for Thyroideum Siccum.—*q.v.*

With the object of standardising Liquor Thyroidei (*Off.*) as to Iodine content, we assayed initially a Liquor made at the end of

1911. This Liquor had been prepared from thyroids which had not been previously assayed in the fresh condition,—the object of this initial experiment being to ascertain any indication of Iodine content in the Liquor. 10 Cc. were treated with 2 Gm. of crushed Sodium Hydrate, incinerated and proceeded with otherwise exactly as under the Assay Process (W. H. Martindale's) for Dry Thyroid. This amount required 3.5 Cc. and 3.1 Cc. of N/100 Sodium Thiosulphate on two separate trials, showing a mean content of 0.042 % Iodine. 100 minims of the Official Liquor are made to equal 1 entire gland, *i.e.*, a weight of fresh gland of about 70 grains, and the Iodine content in the fresh glands in question was probably in the neighbourhood of at least 0.06% .

Following on this experiment, in March 1912 we prepared a quantity of Liquor Thyroidei from some fresh Thyroid glands which were assayed and found to contain 0.063% Iodine. The Liquor contained 0.015% Iodine. This indicated that about 45% of the total Iodine had been extracted by the process. The Dry Thyroid (*Off.*) from these glands contained 0.24% Iodine (1 of the Dry preparation was yielded by 3.82 of fresh gland). The average weight of the lobes of these glands was only 23½ grains. It would therefore seem desirable that the *Off.* Liquor formula should be altered so that a specified volume should be made equivalent to *weight* of gland and be finally standardised.

## THYROIDEUM SICCUM.

### Assay of Iodine in Thyroid Preparations.

*Suggested standard* 0.2% *Iodine in Organic Combination.*

We have recently conducted a number of experiments to determine the best method of estimating Iodine in Dry Thyroid Gland Preparations. See also Liquor Thyroidei, *antea.* The U.S.P. gives a process which indicates simply the ' presence of Iodine Compounds.' (It also, by the way, safeguards against the presence of Inorganic Compounds by a suitable modified test).

Our first experiments were of an approximate description on five Dry Thyroid preparations of commerce,—the method being as follows :—

0.65 Gm. (10 grains) of the powder (or tablets) were fused with 3 Gm. of a fusion mixture of equal parts of Potassium Carbonate and Dried Sodium Carbonate and the flux dissolved in 10 Cc. of Water, acidified with 5 Cc. of Hydrochloric Acid (*Off.*) and filtered. To the filtrate were added 1 Cc. Starch Mucilage and 1 drop of 2% Sodium Nitrite Solution. We have placed side by side the depths of color obtained with these preparations by this and the U.S.P. method.

| Starch colorations. | U.S.P. method. Colors in Chloroform. |
|---|---|
| No. 1. Light Plum Color. | Light Pink. |
| No. 2. Light Plum.<br>(' Standardised Tablets.') | Light Pink. |
| No. 3. Deep Blue. | Red. |
| No. 4. Deep Blue. | Red. |
| No. 5. Color formed but disappeared on shaking. | Light Pink. |

In these experiments we found that an excess of Nitrite added, tended to decolorise, and that Hydrochloric Acid is not desirable pure Nitric Acid is better—*v. infra.* Experiments with Hydrogen Peroxide and Acetic Acid to liberate the Iodine were no better. By titration with N/500 Thiosulphate in the presence of the Starch No. 3 indicated about 0.3% Iodine, but later experiments showed that this figure is too low.

## PREVIOUS ASSAY METHODS.

Several assay methods have already been described. Amongst these may be mentioned that of R. R. Bennett.—P.J. ii./11,163. In this it is directed to carbonise 5 Gm. Dry Thyroid with 8 Gm. Sodium Hydrate, add a further 2 Gm. Sodium Hydrate and then 2 Gm. Potassium Nitrate,—the whole operation being carried out in an iron crucible at dull red heat. Dissolve in Water 50 Cc., nearly neutralise with Sulphuric Acid and add 15 Cc. Carbon Disulphide; acidify with more acid and then add 2 Gm. Sodium Nitrite. Shake well and pour on to a wetted filter,—shake filtrate with 10 Cc. Carbon Disulphide and pour on to another wet filter. The solutions of Iodine are washed free from Acid and collected in a stoppered bottle and titrated with $\frac{N}{100}$ Thiosulphate in presence of a little Sodium Bicarbonate. Figures obtained from the products of four leading Manufacturers were according to Bennett, 0.315, 0.220, 0.122, 0.038, and 0.2%. No loss of Iodine was observed. The method is substantially the same as that of Baumann,—*vide* next abstract.

Criticising this method S. E. Stuart said he thought the process liable to give low results by reason of the addition of Nitre and the carrying of the ignition to complete combustion. A process adopted in his laboratory was substantially to mix 1 Gm. dried glands with 10 Cc. Liquor Potassæ and evaporate to dryness on a sand bath, igniting until completely charred, washing through a filter up to 50 Cc. with Water and estimating Iodine by the method of Stanford who used Nitrosulphuric Acid made by saturating strong Acid Sulphuric with Nitrous fumes from a mixture of Starch and Nitric Acid. —Y.B.P. 1883, p. 530—or by any usual method. Dry Thyroid obtained from 2,500 glands collected May and June 1911 yielded according to him 0.35% Iodine and that from 300 glands collected the second week in July, 1911, yielded 0.38% Iodine. He suggested a standard of 0.25%, but thought more figures should be collected all over the country for different months. Others said that fusion with Nitre tended to produce Iodate and hence cause loss.

Our opinion, from work which we have done with the above and other methods, is that (1) 5 Gm. of dried glands is not necessary, 2 Gm. ought to suffice; (2) the washing of the Carbon Disulphide Solution on the filter paper is not practicable; (3) Carbon Disulphide is not a good immiscible solvent; (4) that the addition of so much Sodium Nitrite tends to decrease the Iodine yield rather than to improve it.

We then tried the following method:—

Boil 1 Gm. of Dry Thyroid or equivalent of Tablets with 2 Cc. Potash Solution (containing 1 Gm. KOH), evaporate to dryness, char slightly. Lixiviate with 25 Cc. Water, filter. To 20 Cc. of filtrate add Sodium Nitrite 0.5 Gm. Place in a separator, add carefully Nitric Acid 2 Cc., and shake out with Chloroform; titrate with N/500 Thiosulphate, 1 Cc. = 0.000254 Gm. Iodine. This we found gave inaccurate results,—it was therefore modified in several directions to determine the reason of loss.

We prepared a **dummy of egg albumen containing 0.2% Iodine** in the form of Potassium Iodide and employed it in various ways.

The U.S.P. process (*v. antea*) we found gave better results so far as depth of color of the resulting Chloroform Solution is concerned. (It is quite possible to estimate within limits colorimetrically the exact amount of Iodine).

It will be noted that the U.S. process differs from our trial method in (1) using Sodium Hydrate in place of Potash. (2) in using Potassium Nitrate which we omitted. It is a curious fact that to get the entire amount of Iodine out of the Thyroid-Alkali fuse, the addition of Potassium Nitrate seems essential.

This we proved as follows:—

(i) The addition of Potassium Nitrate to our Potash method increased the Iodine.

(ii) The omission of Potassium Nitrate from the U.S. method decreased the color.

## *Sources of Error.*

There are several sources of error to be guarded against,—the Nitric Acid employed to liberate the Iodine should be Chlorine-free, otherwise Iodine-chlorine Compounds may result and vitiate the result. Again, it occurred to us that the *amount of Sodium Nitrite* and the *kind of acid* used might effect the yield, but blank experiments (not fused) using a simple Potassium Iodide Solution, 25 Cc. of which equalled 0.003825 Gm. Iodine gave with—

(*a*) 2 Gm. Sodium Nitrite and 4 Cc. Nitric Acid by titration with N/500 Thiosulphate 0.00381 Gm. Iodine.

(*b*) 0.05 Gm. Sodium Nitrite + Cc. Nitric Acid 0.0033 Gm. Iodine.

(*c*) 0.05 Gm. Sodium Nitrite + 1 Cc. Sulphuric Acid 0.003556 Gm. Iodine.

A further point occurred to us, *viz.*, that possibly the presence of Nitrous Acid in an improperly washed Chloroform Solution of the Iodine might affect the titration even in the presence of Sodium Bicarbonate, but here again experimental evidence was to the contrary.

The presence of Nitrite in the Chloroform Solution in the presence of Sodium Bicarbonate does not affect titration. Results of estimation of Iodine by different methods of combustion in the dummy containing 0.2% Iodine were as follows :—

(1) Using 2 Cc. 50% Potash Solution without Potassium Nitrate 0.05% Iodine found.

(2) Using 2 Cc. 50% Potash Solution with 2 Gm. Potassium Nitrate 0.155% Iodine found.

(3) Using 1 Gm. Sodium Hydrate without Potassium Nitrate 0.0952% Iodine found.

(4) U.S. method using 1 Gm. Sodium Hydrate with 2 Gm. Potassium Nitrate 0.1746% Iodine found.

(5) Using 1 Gm. Sodium Hydrate with 1 Cc. 50% Potash solution without Nitre 0.1353% (mean of 3 results).

(6) Using 1 Gm. Sodium Hydrate + 1 Cc. 50% Potash Solution 2.0 Gm. Potassium Nitrate gave 0.1662% Iodine (mean of 2 results).

All the above were incinerated after mixing the Dry Thyroid with the fusing materials with glass rod in crucible.

(7) Mixing 1 Gm. substance with 1 Gm. Sodium Hydrate in mortar, transferring to crucible and rinsing mortar out with another another ½ Gm. Sodium Hydrate, fusing finally with 2 Gm. Potassium Nitrate gave 0.1549% Iodine.

(8) Estimations by Bennett's process—0.158% Iodine using 2 Gm. (one experiment).

So far therefore there seemed to be a loss of 25% to 50% of Iodine in all the modifications in these dummy experiments. The actual examinations of the Thyroid Gland preparations were more encouraging, but one can place no reliance on results where controls are unsatisfactory.

Our process (W.H.M.) is therefore as follows :—

Weigh 2 Gm. of the Dry Thyroid, mix most intimately with 2 Gm. of crushed Sodium Hydrate in a small glass mortar to produce a uniform powder. Heat in a porcelain crucible about 5 Cm. in diameter until the mixture becomes uniformly grey. Allow to cool. Scrape out the ash carefully into the same mortar, reduce to fine powder, mix intimately with 1 Gm. of powdered Potassium Nitrate ; transfer to the crucible, heat over Bunsen flame until white or almost so (blowpipe is not necessary on either occasion). Dissolve the flux in about 50 Cc. of Water. Place the solution in a separator, add about 30 Cc. of Petroleum Ether, and then carefully sufficient 25% Sulphuric Acid in portions to render distinctly acid to litmus paper—shaking slightly with each addition so as to "catch" the Iodine in the solvent as it is liberated. After thorough shaking remove the aqueous layer and repeat the extraction with about 20 Cc. Petroleum Ether and a drop or two of 10% Sodium Nitrite Solution. Combine the Petroleum Ether Liquors, wash with water and titrate with N/500 Thiosulphate. (Note.—For 2 Gm. of a 0.2% preparation about 14 to 16 Cc. of Thiosulphate Solution will be required,—the addition of the Sodium Nitrite Solution is not really necessary).

By this process our dummy=0.2% Iodine gave an average of 0.195% on four determinations.

The commercial samples of Dry Thyroid mentioned before gave the following average percentages of Iodine :——

| | | | |
|---|---|---|---|
| No. 1. | 0.029%. | No. 4. | 0.387%. |
| No. 2. | 0.149%. | No. 5. | 0.082%. |
| No. 3. | 0.514%. | | |

It is certain the Iodine content in Thyroid Glands varies in different countries and at different seasons. **The No. 3** we may mention came from two **Provinces in Holland,** and may be deemed exceptional. They were **actual** sheeps' glands (not pigs'). It is just possible their feeding by the sea-shore had something to do with the remarkable content. The 0.514% in the dry gland would equal 0.1% Iodine in the fresh gland. The time of year (July) would also affect the yield. Since these assays were conducted, in March 1912, we found 0.063% Iodine in fresh glands from the same source and 0.24% Iodine in Dried Thyroid Glands from same (1 part of Dry Thyroid was=3.82 of fresh gland) The average weight of the lobes of these glands was 23½ grains—they varied enormously—from 15 to 90 grains.

Further, we obtained the thyroids from a number of **English South Down Sheep** (bred near Southampton) slaughtered January, 1912,—these glands may therefore be considered as a typical winter collection. The fresh substance yielded 25% Thyroideum Siccum *Off.* (*i.e.*, 1=4 of fresh gland). The weight of glands was taken within two hours of slaughtering, hence there was no appreciable loss of natural moisture. On assay by our process we found the dried powder to contain 0.368% Iodine which is equivalent to 0.092% Iodine in the fresh gland. We purpose obtaining further supplies from the same source at other seasons of the year for comparison. It will be noticed that these glands were apparently drier than our summer supply,—whether this is due to season or locality is open to discussion.

A paper by S. P. Beebe in the New York Med. Jl. 8/7/11, *v. infra*, gives the content of Iodine in mgr. per Gm. of fresh substance from sheep as from 0.006 to 0.415, *i.e.*, 0.0006 to 0.0415% or from 0.003 to 0.2 % Iodine on the dry gland approximately. This is a remarkable variation. Pigs' glands are stated to contain more,—

*viz.* 0.0084 to 0.288% in the fresh glands.
Ox Glands 0.003 to 0.147% in the fresh glands.
Human Glands 0.006 to 0.08% in the fresh glands.

Results in Europe with regard to sheep seem therefore to be better than in the United States.

It is well known that the activity of Thyroid preparations varies greatly. This is quite likely due directly to their varied Iodine content. In view of the fact that no Iodine Standard exists officially for Dry Thyroid and that Iodine content may be taken to indicate the amount of therapeutic activity it seems desirable to decide upon a reliable process of estimation and fix a standard,—we suggest as *standard* 0.2% ***Iodine in Organic Combination*** (with a test to exclude Inorganic Iodine.—*c.f.* U.S.P.)

*Note.*—'The activity' of the thyroid gland has been attributed to thyro globulin, an albuminous substance containing Iodine—the percentage of Iodine may therefore be a measure of the activity of a thyroid preparation provided the glands have not been subjected to any treatment that would cause alteration in this substance. B.M.J. i./10,1242.

## *References.*

A sample of dried gland showed 0.44% Iodine by a process, fusing 5 Gm. of the substance with 50Cc. of 6% Potash Solution and 2 Gm. of Nitre in a nickel crucible extracting with boiling water, filtering direct into a separator adding 20 Cc. of Dilute Sulphuric Acid, 15 Cc. of Carbon Tetrachloride, then excess of Sulphuric Acid and 2 Gm.Sodium Nitrite. The liberated Iodine was shaken out with a further 10 Cc. of Carbon Tetrachloride, the latter washed with 8 Cc. of water, finally adding 0.5 Gm. Sodium Bicarbonate and titrating directly into the separator with N/50 thiosulphate without using starch.—Evans, Anal. Rep., 1911.

U.S. Pharmacopœial Standard for Desiccated Thyroid Glands. A close relationship has almost invariably been found between the Iodine content and the physiological activity of Desiccated Thyroid Gland.—Am. Jl. Ph,. Sept. 1911, pp. 407—411.

The **Baumann Method** of assay consists in fusing with Caustic Alkali, liberating the Iodine, extracting with immiscible solvent and estimating colorimetrically. The **Hunter** method differs from this in using Alkali Carbonate for fusing; conversion of the Iodine into Iodate and estimating its amount by a volumetric procedure.—Hunter, Jl. Biol. Chem. 7, 321, 1910.

A number of Assays by Hunter's method showed an average yield in recent samples of American Dry Thyroid to be 0.2% approximately. This is suggested as Standard for U.S. with a latitude of 0.03%, *i.e.*, the standard would be 0.17 to 0.23%.—Reid Hunt & Atherton Seidell.—Am. Jl. Ph., Sept. 1911, pp. 407-411.

The thyroid and parathyroid glands are entirely distinct. The parathyroid contains no trace of Iodine. The nucleo-proteid from this gland has been found effective in relieving tetany.

The functional capacity of the thyroid is very nearly if not quite, in direct proportion to its content of Iodine. The Iodine contents in milligrammes per gramme of fresh gland from the *pig*, *sheep*, *ox*, etc., mentioned in this paper are stated above in our monograph on the Assay.

Iodine is thought to be contained in the thyroid as di-iodotyrosin, but there is uncertainty as to this. Iodothyreine is generally prepared by the hydrolytic action of some mineral acid or by digesting glands with Hydrochloric Acid and Pepsin—the substance however, is not a definite one like Adrenalin. Clinical results show that thyroid administered by the mouth is efficacious and that a very small quantity of Thyroid is sufficient to show decided action. Iodothyreine clinically was stated to be without action. The best method of administering the iodised proteid compound which is responsible for the effect is to give to an animal its own biological sort of thyroid hypodermically, human thyroid should be given to the human animal. It has been reported that thyroid feeding has very marked effect upon the synthesis of urea from ammonia in the liver. The action of the thyroid on the heart is yet without proper explanation. The tachycardia has been explained on the grounds of paralysis of the vagus but more recently the thyroid proteid bodies have been thought to directly injure the heart muscle. Goitre has been produced in normal animals by feeding on water from goitrous springs—these animals being found to have hypertrophied hearts. With regard to etiology of goitre, experiments showed that in individuals drinking from a so-called goitrous well gross enlargement of the thyroid was noticeable after a few weeks unless water were boiled. Water-borne contagion will pass through a Berkefeld filter but will not stand either boiling or heating to 80° C. for half an hour. The infection is therefore either an organism or a very labile chemical compound. A large number of patients develop Graves' disease immediately following severe emotional disturbance or nervous shock. These individuals of course carry a gland capable of reacting to this kind of stimulation, but it is certain that in 40% of the cases the stimulation occurred just before symptoms developed. Antithyroid Serum treatment etc. stated to be effectual—out of 1,500 cases treated 15 to 20% were failures, 50% cured.—"*Recent developments in the Physiology and Pathology of the Thyroid Gland.*"—*S. P. Beebe.* "*New York Medical Journal*" 8/7/11.

# MINERAL WATERS.

*The following information regarding mineral waters has been obtained by applying in most instances direct at the sources.*

*The arrangement of the paragraphs is as follows:—*

*The name of the water and locality is given, then follow in order the names of spring or springs, the nature of the water, the chief chemical constituents, the medicinal uses, the season, if any, at the health resort, and an indication as to whether the water is imported in the bottled condition. The accounts of some are, however, condensed. 'Sulphurous' is to convey Sulphuretted Hydrogen with (usually Sodium) Sulphates and Sulphides.*

See also "Selection of Patients for Spa Treatment."—A recent treatise on the subject.—N. Wood.—L. ii./09,1276.

Mineral Waters for *Intravenous and Intramuscular injections* as Artificial sera. See *Vol. I.* p. 727.

☞ We have adhered to the letter of the law viewing mineral waters containing Arsenic as 'Medicinal Preparations of Arsenic,' but obviously we are concerned here *de minimis* in some instances—in others again the amount is very considerable.

**Adelheidsquelle** (Bavaria).—Saline Tonic. Sodium Chloride and Carbonate, Carbonic Acid. Skin affections, rheumatism, gout, women's diseases. May to Sept. Imported.

**Aedipsos** (Grecian).—Saline thermal. **Aegina** (Grecian).—Alkaline Imported.—Ph. Notes.

★**Aesculap** (Hungary).—Aperient. Magnesium and Sod. Sulphates, Sodium Chloride and Calcium Sulphate. Occasional and habitual constipation, bowel and liver disorders. Imported. See also Table of Mineral Waters.

**Aix-la-Chapelle** (Aachen, Prussia).—Saline, Sulphurous. Both drunk and for baths. Sodium Chloride, Sodium Bicarbonate, Sodium and Potassium Sulphates, some Sulphuretted Hydrogen, Carbonic Acid. Rheumatism, gout, stiff joints, skin diseases, syphilis. 15th May to 30th September, also winter season 15th September to 31st March, and imported. See also Table of Mineral Waters:

**Aachener Trinksalz.**—Mild aperient, used for gall-stones and liver complaints—blood purifying, also **Aachener Badesalz** strengthening and 'recuperating' in rheumatism, gout, etc., and **Pastillen** of the salts with sugar—for cough and catarrhs, prepared from the above, are supplied.

**Aix-les-Bains** (Savoy).—Anti-rheumatic. Sulphur and a curious organic matter called Baregine, which renders it easy of digestion, oily and suitable for massage. Rheumatism, gout and throat diseases. 1st April to end of October.

**Alet** (Aude, France).—Source des Bains and Source Nouvelle.—Alkaline carbonated. Debility, dyspepsia, anæmia. Imported.

**Alexanderbad** (Bavaria).—Chalybeate. Anæmia, chlorosis, incipient phthisis. May to October,

**Alexisbad** (Germany). 3 springs: Alexisbrunnen, Schönheitsquelle, Stahlbrunnen or Grotte.—Chalybeate, Iron, Manganese, Potassium Chloride, Free Carbonic Acid. Anæmia, diabetes, nervous diseases and women's diseases. May 20th to September 20th.

**Allevard** (ISÈRE, FRANCE).—Sulphurous carbonated. Calcium and Magnesium Bicarbonates, Sodium Chloride, Calcium, Sodium and Magnesium Sulphates, free Sulphuretted Hydrogen, Carbonic Acid and Nitrogen. Chest affections of all kinds, skin diseases, women's diseases, rheumatic complaints, June 1st to September 30th, and imported.

**Alvaneu-Bad** (Near Engadine).—Sulphurous. Alpine Climate.

**Andros** (GRECIAN).—Chalybeate. Imported.—Ph. Notes.

★**Apenta** (near BUDAPESTH).—Aperient. Magnes, Sodium and Calcium Sulphates, Sodium Chloride with small quantities of Lithium and Potassium Sulphates. Habitual constipation, hepatic torpor, congestion, hæmorrhoids, gall stones, gout, uric acid diathesis. Imported. See also Table of Waters.

★**Apollinaris** (NEUENAHR, GERMANY).—Acidulated alkali table water. Sodium Chloride, Calcium and Magnesium Bicarbonates, with large excess of Carbonic Acid. Catarrhal affections of the respiratory organs and mucous membrane acute and chronic laryngitis, bronchitis, dyspepsia, gout and gravel. Imported. See also Table of Waters.

**Arabella** (HUNGARY).—Saline aperient. Magnesium, Sodium Sulphates, similar to Apenta. Obesity, gout, rheumatism liver and kidney disorders. A mild purge.—L. ii./03,322. Imported.

**Arnstadt** (GERMANY).—Saline, Sodium Chloride. Scrofula and skin affections. April to September.

⊕**Baden-Baden** (GERMANY). — Arsenical, Lithiated. Anæmia, chlorosis, gout, dyspepsia, paralysis. Summer and imported.

**Baden** (near VIENNA).—Sulphurous. Calcium and Sodium Sulphates; rises warm and contains free Carbonic Acid. Rheumatism, gout, diseases of bones and joints, metallic poisoning, scrofula and syphilis. Throughout the year.

**Bagnères-de-Luchon** (HAUTE GARONNE) and **Bagnères-de-Bigorre**(HAUTES PYRÉNÉES, FRANCE) Labassère.—Sulphurous. Skin, lung and rheumatic affec tions. Imported.

**Bagnoles-de-L'Orn** (NORMANDY, FRANCE) Grande Source.—Small quantities of Sodium Chloride, Sodium Sulphate and Silica, also traces of Potassium Iron and Calcium Salts. Used chiefly as baths and douches but is also drunk Phlebitis, varicocele, women's diseases and rheumatism. May 15th to October 1st, imported.

**Barèges** (HAUTES - PYRÉNÉES, FRANCE).—Sulphurous, warm. Sodium Sulphydrate and Sulphate, Sodium Chloride, Silica. Chronic rheumatism, skin and bone diseases. Imported.

**Barium** (LLANGAMMARCH WELLS, WALES).—Saline. A tumbler full three or four times daily. Sodium, Calcium, Magnesium and Barium Chlorides. Good organically. Only 0·0056 grs. per gallon of Albuminoid Ammonia. Contains no sulphates owing to presence of Barium. Heart affections glandular swellings, skin affections, rheumatism. Bottled, both aerated and still.

**Bath.** The only thermal spring in England, and one of the oldest in Europe. Recent improvements and accommodation. — B.M.J. ii./09,157. King's Bath Spring.—Calcium Sulphate 102.88 grains, Sodium Sulphate 23.5, Magnesium Chloride 15.8 grains, per gallon, and other Salts in less proportion. Radium has been found in the waters and deposits, also Argon, Helium, Krypton and Xenon.—Pres., May 1911.

King's Well contains 0.1387 mgr. Radium per million litres. If the *Niton* (emanation) were represented by the weight of Radium capable of forming the Niton present in a million litres of water or gas, the figures for the water of the King's Well, Cross Bath and Hetling Bath are respectively 1.73 1.19, and 1.7 and for the gas from the King's Well 33.65. The gas from the King's well contains about four times as much Niton as is contained in the natural gas from Buxton, *viz.*, 7.7 and 8.5 mgr. per million litres.

A patient taking a bath probably absorbs some Niton through the skin and undoubtedly through the lungs. The skin absorption of Niton would be increased by connecting the patient with the negative pole of a battery (at a potential of 100 volts or even more) and placing the other pole in the bath. In a bath containing a cubic metre of Bath water there would be roughly one-thousandth of a milligram of Niton, which apparently is not a dangerous dose. Administration of stronger doses is possible with a spraying-machine, especially if natural gas be used for breaking up the fluid, when the potency would be nearly twenty times that of the water.—Sir Wm. Ramsay B.M J. i./12,617. L. i./12,746 ; P.J. i./12,373. (See also SULIS, *i.e.*, Bath water aerated and bottled).

**Bellthal** (MOSEL SPRUDEL bei COBERN a.d. MOSEL, GERMANY).—Table water. Free from organic impurity. Summer.

**Ben Rhydding.** See **Ilkley.**

**Berka** (WEIMAR).—Chalybeate and Sulphurous. In anæmia and rheumatism. 'Moor' and sand baths. May to October.

**✱Bethesda** (WISCONSIN, U.S.A.).—Alkaline, Calc. and Magnesium Bicarbonates. Kidney diseases, Bright's disease, diabetes, torpid liver, dyspepsia, insomnia. Imported.

**Bilin** (BOHEMIA).—Alkaline acidulated table water, Sodium Carbonate, Sodium Chloride, Sodium Sulphate, Lithium Carbonate, Free Carbonic Acid. Catarrh of the stomach and of the respiratory organs, rheumatism and for Bright's disease. Summer and imported. Pastilles are also prepared.

**Birmenstorf** (SWITZERLAND). — Saline aperient. Constipation, jaundice, hæmorrhoids, uric acid. Imported.

**✱Birresborn** (VULKAN, EIFEL, GERMANY).—Alkaline, slightly chalybeate table water. Sodium, Magnesium, and Calcium Bicarbonates, Sodium Chloride, Carbonic Acid. Dietetic. Imported.

**Bocklet** (near KISSINGEN, GERMANY).—Chalybeate. Anæmia, nervous and women's diseases. Imported.

**Bonifacius** (at SALZSCHLIRF, HESSE-NASSAU).—Saline Lithiated. Gout, gall stones, stimulates intestines and urinary organs. May to Oct. Imported.

**Bonnes** (see EAUX BONNES).

**Ⓦ Bourboule, La** (PUY DE DÔME, FRANCE), Choussy-Perrière Spring.—Arsenated. 1 litre=0·028 Gm. Crystallised Sodium Arsenate (1·9 grs. per gallon), Sodium Chloride and Bicarbonate. *Dose*, a large tumblerful. Debility, anæmia, chest affections, arthritis and diabetes.—B.M.J.E. i./06,60. Imported.

**Brides-les-Bains** (FRANCE).—Alkaline saline. Obesity, uric acid, constipation. Imported.

**Bruckenau** (GERMANY).—Ferruginous. For women's diseases, anæmia. Imported.

**Brucourt** (CALVADOS, FRANCE). "Star" Spring.—Chalybeate. Tonic in anæmia. Imported.

**Buda-Pesth ✱St. Lucasbad** (HUNGARY). (*v.* **Kristaly.**)—Warm Sulphurous, Potassium, Sodium and Calcium Sulphates. Sulphuretted Hydrogen. For bathing, sulphur mud baths, in chronic rheumatism, sciatica, gout, skin affections. Internally, the hot sulphurous springs for intestinal diseases, constipation, hæmorrhoids. Frequented all the year round.

**Buffalo Lithia** (MECKLENBURG Co., VA., U.S.A.).—(No. 2 the chief spring) Alkaline Lithiated table water. Albuminuria, uric acid diathesis, and other affections needing alkaline treatment. June 15 to October 1, and imported.

**Bulgarian Waters.**—43 Springs on the South side of the Balkans.—B.M.J. ii./07,536.

**Ⓦ Bussang** (VOSGES, FRANCE).—Ferruginous tonic and digestive. Free Carbonic Acid, Sodium, Calcium, Magnesium Bicarbonates with Manganese, Iron and Arsenic. Anæmia, chlorosis, jaundice, gout, rheumatism, diseases of women. 15th June to 15th September, and imported.

**Buxton** (DERBYSHIRE).—Slightly Saline. Sodium Chloride, Magnesium Carbonate, Calcium Carbonate, Free Nitrogen and Carbonic Acid. Stomach, bladder, liver, and kidney disorders, skin affections, gout, rheumatism, sciatica. All the year round and bottled. See also Table of Waters.

The gentlemen's Natural Baths contain 1.1 mgr. per million litres of *Niton*, *i.e.*, about the same as the Cross Baths at Bath.—Sir Wm. Ramsay.—B.M.J. i./12,617 ; L. i./12,746 ; P.J. i./12,373.

**✱Cachat** (*see* EVIAN, Source Cachat).

**✱Cambrunnen** (TAUNUS, GERMANY).—Alkaline, dyspepsia, rheumatic affections, skin diseases. Imported.

**Capvern** (Hautes Pyrénées, France).—2 springs; Houn-Caoude (drinking) and Bouridé (baths). Alkaline. Catarrh of bladder, gravel, gall stones, women's diseases. May to October. Imported.

**Carabana** (Spain).—Purgative. Sodium Sulphate. Intestinal and hepatic affections and dypepsia. Imported.

**✶Carlsbad** (Bohemia).—Several similar springs, that known as ✶Sprudel is the most favored. Alkaline, Lithiated. Obesity, constipation, stomach, intestinal, liver, kidney and bladder disorders, gout and diabetes. July mainly. Imported. **✶Carlsbad Sprudel** salts (powder and crystals) are also supplied. See also Table of Waters.

**Cauterets** (Pyrénées).—Sulphurous. Sulphuretted Hydrogen, Iodine. Skin and lung diseases, glandular swellings. Summer and imported.

**Cerigo** (Grecian).—Chalybeate. Imported.—Ph. Notes.

**Challes** (Savoy).—Sulphurous. Chronic catarrh, skin affections and intestinal diseases. May to October. Imported.

**Charlottenbrunnen** (Silesia).—Chalybeate.

**Chateldon** (Puy de Dome, France).—Alkaline Acidulated. Stomach and urinary disorders, anæmia and as a table water. Imported.

**Chatel Guyon** (Auvergne, France). Source Gubler.—Alkaline. Dyspepsia, jaundice, anæmia, constipation, uric acid. May to October. Imported.

**✶Cheltenham.**—Pittville Waters: No. 1 Cheltenham Alkaline, Sodium Chloride, Sulphate and Bicarbonate; No. 2 less Sodium Chloride more Sulphate; No. 3 more Sodium Sulphate but less than No. 2; No. 4 **Cheltenham 'Magnesia'** (Magnes. Sulphate 117 grains per gallon) and Sodium Sulphate. No. 5 is No. 4 concentrated. No. 6 is Cheltenham Sodium Sulphate Saline, Sodium Sulphate in predominance. See also Table of Waters.

**Claudia** (Sorgente di Anguillara, Sabazia, near Rome).—Alkaline. Carbonic Acid with small quantities of Alkaline Bicarbonates. Gastric dyspepsia. Imported.

**Condal** (Rubinat, Lérida, Spain).—Aperient, Sodium, Magnesium, Calcium and Potassium Sulphates, Sodium Chloride. As a purgative for habitual constipation, plethora, &c. Imported. See also Table of Waters.

**Condillac** (France).—Alkaline acidulated table water. Imported.

**Contrexéville** (Vosges, France). Pavillon Spring.—Alkaline, Antirheumatic. Gouty affections, dyspepsia, eczema, catarrh of the bladder and liver. 20th of May to 20th of September, and imported. Contrexéville Source Mignon is also supplied. See also Table of Waters.

**Dax** (called locally La Néhe). Thermal—has temperature 61° C. Owing to evolution of Nitrogen appears to be boiling. Contains Sulphates and Chlorides of Calcium and Sodium. The mud contains a large proportion of living algæ—the Oscillaria calida. Is distinctly radio active. In rheumatism. —B. & C.D. i./06,67.

**Desaignes** (Eau de César) (Ardêche, France).—Alkaline, Acidulated. Table water. Imported.

**Dolecoed.** See **Llanwrtyd.**

**✶D'Orezza** (Corsica). Chalybeate table water. Anæmia, dyspepsia; useful after prolonged illness, or for weakness. 1st July to 1st September. Imported.

**Driburg** (Westphalia).—Chalybeate, Tonic, Aperient. Sodium Sulphate, Magnesium Sulphate, Bicarbonate of Calcium, and Magnesium, some Iron and Maganese, Carbonic Acid. Stone in the kidney and kidney diseases generally, neurasthenia, nervous diseases, women's diseases, anæmia. May 1st to October 10th, and imported.

**Droitwich.** See **✶Wychia.**

**Eaux Bonnes** (Basses Pyrénées, France).—Mild Sulphurous. Helium is given off by the water—due in all probability to radium-containing mineral at the source. Similar to Barèges and Cauterets. Bronchial catarrh, phthisis, neurasthenia, asthma. June 1st to October 1st and imported. Has reputation of curing sterility in women. *c.f.* Franzensbad.

**Eilsen** (Schaumburg-Lippe, Germany).—Sulphurous, Calcium Sulphate, Sulphuretted Hydrogen, Carbonic Acid. Asthmatic affections, neurasthenia, cardiac asthma, bronchial affections, chlorosis. 15th May to 31st August.

**Ems, Bad-** (GERMANY).—Several springs: Kränchen, Kessel-brunnen, Kaiser-brunnen, Victoria, Fuersten-brunnen, Alkaline Saline; rises warm. Sodium, Calcium and Magnesium Bicarbonates, Sodium Chloride, free Carbonic Acid. Indigestion, asthma, emphysema, gout, useful in coughs with expectoration, and pulmonary catarrh. May 1st to September 30th, and imported. See also Table of Waters.

**Enghien-les-Bains** (near PARIS).—Sulphurous. Lung and skin affections, uterine disorders, nervous diseases, nose and ear affections. May 1 to Oct. 15. Imported.

**Epidauros** (GRECIAN).—Imported.—Ph. Notes.

**✶Esvach.**—Aperient. Magnes. Sodium and Potassium Sulphates and Bicarbonates, free Carbonic Acid. Habitual constipation, indigestion, biliousness, gout. Bottled.

**Evian-les-Bains** (HAUTE SAVOY) Sources "Cachat" and La Croix,—Alkaline table water. Calcium and Magnesium Bicarbonates, free Carbonic Acid. Liver and intestinal disorders. For washing out bladder in uric acid troubles; calculi, cystitis. May to October. See also Table of Waters.

**Fachingen** (NASSAU, GERMANY).—Alkaline Acidulated. Bicarbonates of Alkalies and Alkaline earth metals. Said to be bacteriologically pure, and to be useful in infectious diseases, *e.g.*, typhoid, cholera, also for use in the tropics in malaria, and for intestinal diseases, gastric catarrh, heartburn, uric acid, rheumatism, diabetes, nephritis. Imported.

**Fango Mud Springs** (ITALY).—Installation at Matlock. For the treatment of rheumatism.

**Fiuggi** (ITALY).—Saline. Sodium Chloride, Potassium Nitrate, Calcium Carbonate, Carbonic Acid, Ozone, and Oxygen, (possibly due to action of radium emanations contained), Nitrogen. Gastric complaints. Imported. Full report on.—L. ii./07,915.

**Flitwick** (near AMPTHILL, BEDFORDSHIRE).—Ferruginous, Ferric Persulphate and Sodium Sulphate. Anæmia, chlorosis, dyspepsia, general debility and neuralgia. Bottled.

**Folkestone** contains about 2½ to 3 grains of chalk per pint—if boiled about ½ grain—which cannot be considered deleterious or have any bad effect. Folkestone water is exceedingly pure, containing a trace only of Free Ammonia and 0.0008 grain per gallon of Albuminoid Ammonia. Total Hardness 18.7. Permanent Hardness 2.9 grains per gallon. Constipation is often produced by a visit to seaside towns. It is claimed that this is more likely due to climate and change than to effect of the water. Constipation is common amongst sailors who drink condensed water—it cannot in this case be ascribed to chalky water.—B.M.i./11,1430, L. i./11,1642. ii./11,158.

**✶Fontalis.**—A pure table water. Alkaline. Chlorides and Carbonates, free from Lime and Magnesium Salts. Bottled at Harrogate.

**Forges** (NORMANDY).—Chalybeate. Ferrous Bicarbonate. Chlorosis, dyspepsia. June 1st to October 1st. Imported.

**Franzensbad** (BOHEMIA).—Aperient, Alkaline, Ferruginous. Intestinal catarrh, enlarged liver and spleen, Bright's disease, gout, scrofula, anæmia, general debility, diabetes. Also mud baths. May to September. Imported.

Has been recommended in heart affections. Has powerful effect on the blood, mucous membranes, and nervous system.—M P. Sept. 23,/08,338.

Enjoys a reputation of curing sterility in women. Thyroid secretion is thought to be evoked.—B.M.J. ii./09,1265.

**✶Franz Joseph** (BUDA-PESTH, HUNGARY).—Aper. Magnesium, Calcium and Sodium Sulphates, Carbonic Acid. Habitual constipation, diseases of the liver, for piles, biliousness, headache, catarrh of the stomach and intestines, Imported. See also Table of Mineral Waters.

**✶Friedrichshall** (SAXE-MEININGEN, GERMANY). Aperient. Magnesium and Sodium Sulphates, Sodium Chloride, Magnesium Chloride. Constipation, intestinal complaints, biliary disorders, gallstones, gravel, gout, scrofula; an active diuretic and for hæmorrhoids. Imported. See also Table of Mineral Waters.

**Gastein, Bad-** (AUSTRIA).—Very slight mineral content. Suitable for weak digestion, nervous disorders, paralysis, uterine affections. Imported.

**Geilnau** (GERMANY).—Alkaline table water. Imported.

★**Gerolstein** (Prussia).—Alkaline. Antacid. Imported.

**Giesshubler** (bei Karlsbad, Bohemia.)—Alkaline acidulated table water. Sodium, Potassium, Magnesium and Lithium Bicarbonates, free Carbonic Acid. Intestinal catarrhs, dyspepsia, heartburn, hæmorrhoids and gout. Imported only.

**Gilgit** (Kashmir, India).—Goitre does not occur among the coolies who drink the pure water of the Gilgit river. Total solids 7 grs. per gall. Total Hardness 4, Calcium about 6, free ammonia and organic matter nil.—L. ii./06,1570.

**Godesberger** (Germany).—Table water. Alkaline, Saline, Chalybeate. Imported.

**Grassion** (France).—Bituminous. Throat and chest affections, gastric and vesical catarrh. Imported.

**Griesbach** (Germany) —Tonic ferruginous table water. Iron Carbonate Sodium Sulphate, Calcium Bicarbonate. Imported.

⊕**Guber** (Srebrenica, Bosnia).—Chalybeate. Contains Arsenious Acid Anæmia, skin and nerve affections. Imported.

**Gytje.**—A kind of mud from the Norway fjords used in the "Gytje treatment in balneology for gout and rheumatism.—Ph. Notes.

**Halle** (Bavaria).—Saline Bromo-iodised. Goitre, scrofulous swellings. Imported.

**Harrogate** (Yorkshire).—Sulphurous. Skin and rheumatic affections, anæmia, dyspepsia. Aperient and diuretic. Summer and winter, and bottled. The Sulphur and Alkaline Carbonates compose half the solid ingredients. The Beckwith Spring contains large proportion of Magnesia. Helium has been traced in the gases rising, hence presence of Radium is assumed.—P.J i./05,903.

Some pharmacological effects of the strong sulphur **Harrogate** water. :— A daily excess of urination was observed amounting to 42% when comparing two periods — 11 days without and 11 days with. Similarly weight of fæces showed an increase of 245%. Total Nitrogen showed increase of 8%, Uric Acid 18%, Kreatinin 14%, Phosphates 10%. There is increased oxidation and tissue change, and general metabolism is greatly influenced. In some cases of gout the diminution of amount of urine passed (often under 20 ounces in 24 hours) is rapidly relieved—the diuresis amounting to over 100% and the sp. gr. of the urine does not vary inversely as the amount passed. Indeed, the sp. gr. is often highest at the height of the diuresis.—D. Brown. B.M.J. i./11,1304.

In a previous paper by the same author (B.M.J. ii./10,421) analogous conclusions were given. It may be added from this that exogenous purins excreted are increased. Excretion of endogenous Xanthin bases is decreased.

Sulphuretted Hydrogen content is 10.46 cubic inches per gallon.—B.M.J. ii./11,522.

"**Harrogate Salts.**"—Potassium Tartrate 360 grains, Magnesium Sulphate 1 pound, Sulphurated Potash 1 ounce.—P.J. i./07,518.

**Hathorn** (see Saratoga).

**Homburg von der Höhe** (Germany).—Elizabeth-brunnen, Kaiser-brunnen and Stahl-brunnen. Saline chalybeate, acidulated. Sodium and Magnesium Chloride, Ferrous, Calcium and Magnesium Bicarbonates, Carbonic Acid. Chronic catarrhs of stomach and bowels, habitual constipation, gout, scrofula, chlorosis, inaction of the liver, diabetes and general tonic. May 1st to October 1st, and imported.

★**Hunyadi Janos** (Buda-Pesth) —Aperient. Large percentage of Magnesium and Sodium Sulphates, Sodium Chloride, and Sodium and Calcium Bicarbonates. See also Table. Constipation and biliousness. Imported only.

**Hypate** (Grecian).—Sulphurous. Imported.—Ph. Notes.

**Igmandi** (Komárom, Hungary) Water. Radio-active. Saline aperient. Magnesium Sulphate 29·3, Sodium Sulphate 9·5, Calcium Sulphate 0·7, Sodium Chloride 0·8%. Total solids 40·8 per 1,000 Gm. Radio-activity inherent in the Calcium Sulphate.—L: ii./05,777. Corpulency, constipation, hæmorrhoids, rheumatism.

**Iodbad Lippik.** See **Lippik.**

**Ilkley** and **Ben Rhydding** (Ilkley in Wharfdale.) Chalybeate and

Antacid. (i.) Chalybeate Spring. Ferrous Carbonate, Calcium Sulphate, and Alkaline Chloride. (ii.) "Hygeia" Spring. Calcium, Sodium and Magnesium Carbonates, Sodium Sulphate. (iii.) "Ilkley Wells" Carbonated. Free Carbonic Acid, Calcium Carbonate, Sodium Sulphate. Gout and rheumatism. *See also* **Health Resorts.**

**Johannis** (Hesse-Nassau).—Saline acidulated tonic table water. Calcium-Magnesium and Sodium Bicarbonates, and Sodium Chloride. See also Table, Imported.

**Kaiser Brunnen** (Aix-la-Chapelle).—Table water. Sodium Chloride, Bicarbonates. Gout, rheumatism and dyspepsia.

**Kissingen** (Bavaria, Germany), Rakoczy and Pandur.—Saline, Chalybeate. Sodium and Potassium Chlorides, Iron and Calcium Bicarbonates. Anæmia, general debility, mental exhaustion, heart, liver, and kidney diseases, gout, obesity, and congestions. Imported.

**Kissingen** (Bavaria) Bitter Water.—Aperient, Magnesium and Sodium Sulphates, Carbonic Acid.

**Koenigsdorf** (Oberschlesien, Germany).—Alkaline Iodised. Sodium Chloride, Calcium Chloride, Magnesium Iodide and Magnesium Bromide. To improve blood condition, for nerve and uterine diseases, glandular swellings and skin affections. May 15th to the end of September.

**Krankenheil** (Bavaria).—Sulphurous, Iodised. Sodium Chloride, Iodide and Bromide, Sulphuretted Hydrogen. Goitre and similar swellings, skin affections. Imported.

**Kreuznach** (Prussia).—Iodised Saline. Sodium, Calcium, and Magnesium Chlorides with small quantity of Bromides, Iodides. In syphilis, tabes, phthisis, obesity, anæmia, skin and nervous disorders, goitre, and similar swellings. All the year round. Imported. Kreuznach mother lye contains 3,100 grains of Salts in 20 ounces.—P.J. ii/04,136.

Radio-active substances obtained from residues of these springs. Used in rheumatism, neuralgia and sciatica—L. i./09 1283.

Has a reputation of curing sterility in women *c.f.* Franzensbad.

**✶Kristaly** (at St. Lucasbad. Buda-Pesth).—Table water. Magnesium and Calcium Bicarbonates, Carbonic Acid. In intestinal disorders. Imported.

**Krondorf** (bei Carlsbad).—Alkaline, table water. Chronic catarrh of respiratory tract, also jaundice, gout and allied disorders. Imported.

**✶Kronen-quelle** (Obersalzbrunn, Silesia). — Alk., Saline Lithiated. Sodium Sulphate, Potassium Sulphate, Bicarbonates of Sodium, Magnesium, Calcium, and Lithium. Uric acid diathesis. Imported.

**✶Kronthal** (Nassau).—Saline, table water. Sodium Chloride, Calcium Carbonate. Blue Label.—Plain table water and for dyspepsia. Red Label.—Pick-me-up, rheumatism, gout. Green Label.—Anæmia and tonic.

**Kyllini** (Grecian).—Sulphurous. Imported.—Ph. Notes.

**Kythnos** (Grecian).—Saline, Thermal. Imported.—Ph. Notes.

**Labassère** (Hautes Pyrénées).—See Bagnères de Bigorre.

**Landeck, Bad Landeck** (Prussian Silesia).—Sulphurous. Nervous, skin and rheumatic diseases. Moo-baths. Summer and all the year round.

**Langenbrücken** (Baden).—Alkaline, saline. Sulphurous. Chronic skin diseases, syphilis, rheumatism, gout, bronchial catarrh. May 20 to October 1.

**Latraki** (Grecian).—Alkaline.—Ph. Notes.

**Leamington.**—Saline. Sodium, Magnesium and Calcium Sulphates, Sodium, Calcium and Magnesium Chlorides, Ferrous Carbonate. Dyspepsia, gout, women's diseases, sciatica, glandular swellings and skin diseases. Bottled.

Ⓑ**Levico** (Austrian Tyrol).—Two springs (strong and mild); Arsenical chalybeate. Strong: Arsenious Acid; 0·09 part per 10,000—1-12th of a grain per pint; the Mild is 1-10th of this. Further constituents: Ferrous Sulphate, and Ferric Persulphate. Anæmia, skin eruptions, neuralgia and amenorrhœa. 1st April to the end of October (Vetriolo has season June 1st to the end of September), and imported.

**Lippik** (Slavonia, Hungary).—Iodised water and acidulated. Potassium and Sodium Sulphates, Sodium Chloride, Sodium Iodide, Sodium Bicarbonate Stomach diseases, scrofulosis, rheumatism, gout, glandular swellings. May 1st to September 30th.

**Lippspringe** (Westphalia).—Alkaline, acidulated. Chronic lung affections, intestinal and bone diseases. May to September. Imported.

**Llandrindod** (Wales).—"Strong Sulphur," "Roman Spring," "Magnesium Spring." The first is radio-active. In skin affections, dyspepsia, glandular enlargements, gout, rheumatism. All the year round.

The Sulphuretted Hydrogen waters are of several strengths. One contains a small amount of thallium chloride and a considerable quantity of lithia—latter higher than Royat.—B.M.J.i./09,1245.

**Llangammarch.**—See Barium.

**Llanwrtyd, Dolecoed Spa** (Wales).—Sulphuretted Hydrogen, the strongest in Great Britain.

**Loueche (Leuk** or **Loeche les Bains)** (Valais, Switzerland).—Warm, almost exclusively for baths. Calcium Sulphate, Magnesium Sulphate, similar to that of Bath in England. Rheumatism, gout, women's diseases, skin affections. 1st May to 15th October.

**Luhatschowitz** (Austria).—Saline, with small quantities of Bromides and Iodides. Catarrhal affections, gouty exudations. Imported.

✱**Lullus. St.** (Hersfeld, Hesse), Germany.—Glauber's Salt principal constituent. Stomach, liver, bowel complaints.

**Magnaris.**—A table water prepared at Llandrindod.

**Malvern** (Worcestershire).—Practically free from saline matter, and contains no organic matter. Bladder and kidney diseases and skin affections. Bottled. See also Table.

✱**Malvern Selzer.**—Slightly saline table water.

**Marcols** (Ardèche, France), Source du Lion.—Alkaline table water. Stomach, liver and kidney diseases, rheumatism. Imported.

**Marienbad** (Bohemia).—Several springs, Kreuz-brunnen and Ferdinand-brunnen principal, Alkaline, Saline, Chalybeate, Acidulated. Gout, gravel, hæmorrhoids, brain and nervous diseases, melancholia and chronic gastric catarrh, dyspepsia, gall stones, obesity. Summer, and imported. Also supplied in powder and crystals. Tablets are also made. See Marienbad Salt and Table of Waters.

**Martigny** (Vosges). Lithiated. Gravel, diabetes, liver and kidney complaints.

**Mergentheim** (Wurtemburg), Karlsquelle. — Aperient Water. Magnesium and Sodium Sulphates, Sodium Chloride, free Carbonic Acid. Gout, neuralgia, gall stones, dyspepsia, obesity, rheumatism, diabetes. 1st May to 1st October.

**Meritchleri** (Bulgaria).—Water resembles Carlsbad. A 'coming' resort.—B.M.J. ii./07,536.

**Methana** (Grecian).—Sulphurous.—Ph. Notes. So powerful as to render the place objectionable; the sea into which the water falls is milky, owing to the decomposition of the sulphuretted hydrogen. The bacterium *Beggiatoa nivea* is found in the sediment, and in the protoplasm of this organism particles of sulphur are distinctly visible under the microscope. Imported.

**Metternich** (Bohemia).—Alkaline table water.

**Miers** (Lot, France).—Saline, laxative. Sodium Sulphate, Calcium Sulphate, Magnesium Chloride. Dyspepsia, calculi, migraine, obesity, albuminuria. Imported.

**Missisquoi** (Vermont, U.S.A.).—Sulphurous. Scrofula and other skin affections, diseases of respiratory organs. Imported.

**Mondorf** (Luxembourg).—Saline. Calcium Chloride, Bicarbonates, with small quantity of Magnesium Bromide. Constipation, neurasthenia, anæmia, skin affections, jaundice, rheumatism. May 15th to October 15th. Imported.

Ⓟ**Mont Dore** (Puy de Dôme, France).—Alkaline, Saline. Bicarbonates, Ferrous Carbonate, Arsenic, and Silica. Intestinal disorders, rheumatism, asthma, bronchitis and laryngitis. June 1st to September 20th. Imported.

**Montreux** (Switzerland).—Alkaline table water. Slightly mineralised. Stomach, liver, kidney and bladder affections. Imported.

**Nauheim** (Germany).—Sodium, Calcium and Lithium Chlorides. Skin and rheumatic affections, heart diseases. See also Table of Waters.

**Nenndorf** (Westphalia).—With mud baths. Sulphurous, Calcium Sulphurate, Magnesium Sulphate, Carbonic Acid, Sulphuretted Hydrogen. Claimed to be the strongest sulphurous water in Europe. Rheumatism, neuralgia, skin and bronchial affections, hæmorrhoids, neurosis, &c. May 1st to September 30th.

**Neuenahr** (Prussia).—Acidulated, alkaline table water. Laryngitis, bronchial catarrh, asthma, tuberculosis, liver diseases. diabetes, heart disease. diuretic, Summer, commencing May 1st. Imported as Apollinaris.

For renal elimination, but the place does not appeal greatly to English visitors.—L. ii./09, 1276.

**Nieder Selters.**—See Selters, Nieder-.

**Nocera Umbria** (Angelica Spring, 185 kilometres from Rome). — Alkaline, Bicarbonates. Digestive, anturic, tonic refreshing. Imported.

**Orezza.**—See D'Orezza.

**Oberbrunnen** (Silesia).—Alkaline Lithiated. Uric acid diathesis, nephritis. Imported.

***Perrier** (Vergèse nr. Nismes, France).—Table water, slightly mineralised, organically pure. *Small* proportion of Alkaline Carbonates. Digestive. M.P, June 22/04.

®**Plombières** (Vosges, France).—Mild Saline. Sodium Sulphate, Arsenic, Oxygen, Nitrogen. Neurasthenia, gastralgia, dyspepsia, dilation of the stomach and chronic diarrhœa, rheumatism, skin affections. May to September. Imported. Mucous colitis treated by washing out the colon with the alkaline sulphur water and further bath treatment.—B.M.J. ii./08, 78. Radioactive.—Chem. News, Mar., 1,/08. p. 132.

**Pougues** (France). St. Leger Spring. — Alkaline. Dyspepsia, anæmia, scrofula, gravel, catarrh of the bladder. May 15 to Sept. 30. Imported.

**Pullna** (Bohemia).—Aperient. Magnesium, Sodium and Potassium Sulphates, Sodium Chloride. Chronic constipation, liver and intestinal affections, gallstones, gout and rheumatism, eczema. Imported.

**Pyrmont** (Waldeck, Westphalia). Three springs. Hauptquelle contains most iron.—Chalybeate. Chronic catarrah, digestive and urinary diseases, women's diseases, scrofula, rheumatism and gout. May 1st to October 10th (and imported).

**Quicherat** (France).—Ferruginous. Magnesium and Sodium Chlorides, with some Iron and Manganese, Carbonic Acid. Anæmia, stomach diseases. Imported.

**Ragatz-Pfafers.**—Canton St. Gall, Switzerland. Thermal Spring 99° Fahrenheit. Calcium, Magnesium, and Sodium Chlorides, Bicarbonates, and Sulphates. Very free from bacteria. Rheumatism, gout, sciatica, neuralgia. May to October.

**Recoaro** (Venetia, Lombardy). Sources: Lelia, Lorgnia and Giuliana.—Ferruginous Table Waters. Sulphates. Intestinal and liver complaints. Tonic, easily assimilated. Summer and imported. Royal Bitter Source.—Is pure bacteriologically. Purgative for intestinal complaints.

**Reichenhall** (Bavarian Alps).—Saline. Considerable proportion of Sodium Chloride. Employed principally as bath in scrofula and given for bronchial catarrh. May to September.

**Rennine** (Reipertsweiler, Alsace).—Nitrated. Potassium Nitrate 0·19 Gm. per litre, Alkaline Chlorides. Diuretic, laxative, in heart disease.—L. ii./03,107.

**Renaison** (France).—Alkaline, acidulated table water. Bicarbonates, free Carbonic Acid. Dyspepsia and gastric disorders. Imported.

**Rhens** (am Rhein, Germany).—Alkaline, acidulated table water. Sodium Chloride, Sulphate and Bicarbonate. Imported.

**Rippoldsau** (Baden). — Saline, Acidulous, Chalybeate. Calcium Bicarbonate Manganous and Ferrous Bicarbonates, Sodium Sulphate, free Carbonic Acid Anæmia, scrofula, skin affections, rheumatism, gout, neuralgia. 15th May to 1st October. Imported.

**Roisdorf** (Prussia).—Alkaline, saline, acidulated table water. Easy of digestion, for catarrhs of stomach and intestines, and of respiratory organs, liver and spleen affections and calculi in the bladder.

®**Roncegno** (Valsugana, Southern Tyrol).—Each litre contains 0·109 Gm. Sodium Arsenate, 0·115 Gm. Arsenic Anhydride, 0·03 Ferric Phosphate, 3·12 Gm. Ferric Sulphate, also Sulphates of Copper. Magnesium, Nickel and Cobalt.

Baths (20—30 for a course). *Average dose*, four table-spoonsful thrice daily. (=4·5 cg. arsenic.) Anæmia, chlorosis. April 15th to end Oct. | B.M.J. i./07,93. Graves' Disease, 20 out of 37 cases completely cured,—B.M.J.ii./00,992.

**Rosbach** (near Homburg, Germany). — Saline, table water. Calcium and Magnesium Bicarbonates, Carbonic Acid. Gouty and acid dyspepsia. Imported.

®**Royat** (Puy-de-Dôme, France). Three Springs.—Saline, Arsenated [small quantity], Lithiated. Rheumatism, dyspepsia, nervous diseases, women's diseases, anæmia, skin affections and debility. Summer. Imported. Full description of this water.—B.M.J. i./07,758.

**Rubinat** (Pyrénées, Spain). "Llorach" Spring.—Aperient. Rich in Sodium Sulphate and Magnesium Sulphate, and contains Calcium Chloride. Stomachic disorders, constipation, liver and kidney affections. Imported. See also Table of Mineral Waters.

**Rubinat** (Serre).—Similar to the last mentioned, but stronger than the above in the proportion of Sodium Sulphate to Magnesium Sulphate. Uses similar to the above. Imported.

®**Saint Boès** (Basses-Pyrénées, France).—Bituminous, Iodised, and Arsenated. Arsenic, Iodine. Skin, lung, and venereal diseases. Imported.

**Saint Galmier** (Loire, France).—"Badoit" Table water. Dyspepsia, intestinal catarrh, constipation, nervous disorders, hyperæmia. Imported. "Noel."—Alkaline, Acidulated. Uses as latter. Imported.

**Saint Gervais** (Haute Savoie).—Saline. Sodium and Calcium Sulphates, Sodium Chloride. Skin affections, constipation, rheumatism and nerve diseases. 15th May to 30th September. Imported.

★**Saint Lucasbad Brunnen** (Buda-Pesth).—Sulphurous. Rheumatism, neuralgia, and skin affections. All the year round. See also Buda-Pesth.

**Saint Moritz** (Switzerland). "Paracelse" Spring.—Alkaline, Chalybeate, Tonic. Nervous and intestinal disorders, sick headache, hysteria, Graves' disease and for convalescence. All the year round. Imported.

**Saint Sauveur.**—See **Vernet les Bains.**

**Salies de Bearn** (France).—Saline. Sodium Bromide and Iodide. Skin affections and as a general tonic.

**Salins les Bains** (Jura, France).—Tonic. Magnesium Chloride, Iodides and Bromides. Anæmia, tuberculosis, general debility, women's diseases, obesity, and scrofulous affections. Summer. Imported.

**Sallyco.**—Artificial. Is stated to contain Colchicine and Salicylic Acid.

★**Salutaris.**—Still and aerated table water, distilled water. For washing out the system in kidney and liver disorders, also gout and dyspepsia.

★**Salvator Forras** (Hungary).—Alkaline, Lithiated. Uric acid diseases of digestive organs. Imported.

**Salzbrunn** (Austria).—Alkaline. Chronic intestinal diseases, gall stones, rheumatic affections, emphysema. 1st May to 15th October.

**Salzschlirf**—See **Bonifacius.**

**San Pellegrino** (near Milan).—Diuretic Calcium and Magnesium Sulphates, some Carbonate with trace of Chloride, also Lithium. Mineral Salts amount to 1·264 Gm. per litre.—L. i./09,43.

**Saratica** (Austerlitz, Moravia, Hungary).—Purgative. Gout, rheumatism and obesity. Imported.

**Saratoga** (U.S.A.). "Congress" and "Hathorn" springs.—Alkaline, Saline. A mild aperient in dyspepsia, skin affections, diseases of the stomach, liver, kidney, and blood, constipation. Imported.

**Sauerbrunnen** (Hartz, Germany).—Table water. Very slight mineral constituents—Magnesium Carbonate and Sulphates. Imported.

**Schinznach** (Switzerland).—Sulphurous. Skin affections (eczema, acne, psoriasis, urticaria), asthma, gout, rheumatism. 1st May to 15th September. Imported. Has reputation of curing sterility in women. *c.f.* Franzensbad.

**Schlangenbad** (Germany).—Very slight Mineral constituents. Considerable quantity of dissolved oxygen and nitrogen. General tonic. Imported.

**Schwalbach** (Nassau). Weinbrunnen and Stahlbrunnen—Chalybeate tonic. Iron, Calcium and Magnesium Bicarbonates. Anæmia, and as a tonic. Imported.

**Selters,** or **Seltzer Water** (on the Lahn, Nassau), Ober and Nieder.—Alkaline, Acidulated, Table Water. Sodium Chloride, Bicarbonates, Carbonic Acid. Dyspepsia, obesity, gout, rheumatism, bronchial, bladder, kidney, and liver affections. Imported.

**Slanic Spa** (Roumania) Rich in Carbonic Acid, Alkaline, Stimulates secretion by content of Sodium Chloride. Neutralises excess of Hydrochloric Acid by the alkali (Sodium Bicarbonate), B.M.J.E, i./11,40.

**Soulac-sur-Mer** (Medoc, Gironde, France).—Health resort. Sea air.

**Spa** (Belgium).—Ferruginous. Anæmia, uterine and nervous disorders, rheumatism, gout. Summer, and imported.

**Strathpeffer.**—See British Health Resorts.

✱**Sulis** (Bath Water, aerated).—Aperient table water. Calcium and Sodium Sulphates, Magnesium and Sodium Chloride. Gives a radio-active emanation

**Tarasp** (Switzerland), St. Lucius Spring.—Alkaline, Saline. Diuretic. Useful in chronic catarrh of the stomach, dyspepsia, gastralgia, habitual constipation, disorders of nutrition, obesity. 1st June to 15th Sept. Imported.

**Taunus** (Frankfurt).—Muriate, alkaline table water. Digestive. ✱**Taunus Mineral Water.**

**Teplitz** (Bohemia).—Alkaline. Rheumatic and nervous diseases, paralysis Imported.

**Tonalka.** An alkaline tonic aperient water. Supplied in syphons and bottles.

**Thonon** (Lake Léman, France). Alkaline, Carbonated and Benzoated (Balsamic resins are contained). In liver complaints and urinary diseases. Imported bottled.

**Tsagesi** (Grecian). Chalybeate.—Ph. Notes.

**Vals** (Ardèche, France). Springs: Madeleine, Précieuse, Désirée, Rigolette, St. Jean.—Alkaline, acidulated. (Contents vary with the spring.) Rheumatism, anæmia, skin affections. Imported.

**Vernet-les-Bains** (Pyrénées Orientales).—Sulphate. Sodium Sulphate and Thiosulphate. Constipation, skin affections, anæmia. May to October, and imported.

✱**Vichy** (Allier, France). Springs: Grande Grille, Hôpital, Célestins, Parc.—Alkaline, acidulated. Gravel, chronic urinary affections, diabetes, female complaints, gout, rheumatism, facilitates digestion. May 15th to September 30th, and imported.—M.P. Aug. 26,1903.

For renal elimination but does not appeal to English visitors.—L, ii,/09,1276.

**Villacabras** (Spain).—Saline aperient. Sodium Sulphate. Obesity and constipation. Imported.

**Vittel** (Vosges, France). Spring: Grande Source.—Alkaline. Sodium and Magnesium Bicarbonates, Sodium, Calcium and Magnesium Sulphates, Carbonic Acid. Uric acid, scrofula, chlorosis, biliary and urinary congestion. In addition are Source Salée, stronger in Magnesium Sulphate; Source Marie and Source des Demoiselles, Chalybeate. The first two are imported.

Aortitis relieved, pain becoming less frequent. Dyspnœa practically disappeared by a course at Vittel.—B.M.J. ii./08,80.

**Weilbach** (Nassau).—Alkaline, Sulphurous. (A lithiated spring also.) Aperient, for obstructions of the abdominal organs, antisyphilitic, in lung and skin diseases. The beginning of May to the end of September. Imported.

**Wiesbaden** (Nassau). Kochbrunnen.—Antacid. Uric acid affections, sciatica bronchitis and laryngitis. Summer. Imported.

**Wildbad** (Black Forest, Germany).—Alkaline. Warm, (37°C.) Rheumatism, paralysis, neuralgia, scrofula, rickets, bronchial catarrh, urinary diseases. May to October.

**Wildungen** (Waldeck, Germany). Three Springs.—Alkaline. Bladder and urinary diseases, anæmia. Summer. Imported.

**Wittekind** (Halle, Germany).—Sodium Sulphate. Obesity, women's diseases, rheumatism, heart and nerve diseases. 1st May to 1st October.

Ⓑ **Woodhall** (Lincolnshire).—Saline, Bromo-iodised. Bromide, Iodine (free and combined), Sodium Chloride, Arsenic. Gout, sciatica, rheumatism, skin affections, goitre, women's diseases. End of March to end of October.

A large range of diseases from arthritis to eczema may be treated on orthodox principles.—L. i./09,1478.

✱**Wychia** (Droitwich).—Saline. Sodium Chloride 11·93 and Sodium Sulphate 7·89 per litre. Droitwich water is distinctly radio-active. Laxative, habitual constipation and plethora.—L. i./06,38.

## A Table of certain Mineral Waters showing their Approximate Contents in Grains per Pint.

In the following Table we have arranged a brief list of some of the waters, giving their principal constituents from various published analyses. It occurred to us that an arrangement of this kind would be of interest as enabling the physician to see at a glance the relative proportions of the various main elements and the forms in which they occur in the waters. The Salts showing the higher quantities take precedence in each column.

| SPRING. | CHARACTER. | CARBONATES (more or less in form of Bicarbonates). | CHLORIDES. | SULPHATES. | OTHER CONSTITUENTS and authority. |
|---|---|---|---|---|---|
| **Æsculap** | Saline Aperient. | Sodium, 8¾ | Sodium, 25½. | Magnesium, 151¼<br>Sodium, 121¾.<br>Calcium, 18¼. | Traces of Alumina, Iron, Manganese.—J. Molnar. |
| **Aix-la-Chapelle.** | Saline, Sulphurous. | Sodium, 6¼.<br>Calcium, 1½.<br>Magnesium, ½. | Sodium, 25½. | Sodium, 2¾.<br>Potassium, 1½. | Traces of Sulphides, Iodides and Bromides, Lithium, Iron and Strontium.—Baron Liebig. |
| **" " (Kaiser Brunnen).** | Table Water. | Sodium, 8.<br>Calcium, 2.<br>Magnesium, ½. | Sodium, 23. | Sodium, 2½.<br>Potassium, 1¼. | Sodium Sulphide ¼:<br>Traces of Iodide, Bromide, Lithium, Strontium, Iron. |
| **Apenta** | Saline Aperient. | Sodium, 4.<br>Magnesium, 1½.<br>Calcium, 1.<br>Ferrous, ½. | Sodium, 15½. | Magnesium, 184½.<br>Sodium, 164.<br>Calcium, 23.<br>Potassium, ¾.<br>Lithium, ½. | Traces of Bromide, Alumina, etc.—R. C. Tichborne. |
| **Apollinaris** | Table Water. | Sodium, ½.<br>Magnesium, 3¼.<br>Calcium, 2¼. | Sodium, 3¼. | Sodium, 2. | $CO_2$ (Free) 24¼.—Apollinaris Co. |

| SPRING. | CHARACTER. | CARBONATES (more or less in form of Bicarbonate) | CHLORIDES. | SULPHATES. | OTHER CONSTITUENTS AND AUTHORITY. |
|---|---|---|---|---|---|
| **Bath** | Table Water. | Calcium, 1. | Magnesium, 2.<br>Sodium. 2, | Calcium, 11¾.<br>Sodium, 3<br>Potassium, 1. | Traces of Iron, Ammonia, Nitrates. See also p. 113. |
| **Buxton (St. Anne, Thermal)** | Slightly saline gaseous table water. | Calcium, 1¾.<br>Magnesium ¾. | Sodium, ½.<br>Ammonium, ¼.<br>Magnesium, ¼. | Sodium<br>Potassium } ¼.<br>Calcium | Traces of Iron, Manganese and Barium, Sulphates. See also p. 114. |
| **Buxton (Chalybeate)** | Chalybeate. | Ferrous, ½.<br>Magnesium, ¼. | Sodium, ¼. | Calcium. 1¼.<br>Magnesium, ½.<br>Sodium ¼. | Traces of Aluminium and Potassium Salts. |
| **Carlsbad (Sprudel)** | Alkaline. | Sodium, 11½.<br>Calcium. 3.<br>Magnesium, 1½. | Sodium, 9. | Sodium, 21.<br>Potassium, 1½. | Traces of Lithium, Strontium, Aluminium and Fluorine Compounds.—Prof. E. Ludwig and J. Mauthner. |
| **Cheltenham** | Saline Aperient. | Calcium, 4½. | Sodium, 3. | Magnesium, 14¾.<br>Calcium, 8.<br>Sodium, 7½.<br>Potassium, ½. | Traces of Alumina, Iron, Manganese, Bromides, Iodides, Phosphate. |
| **Condal** | Aperient. | — | Sodium, 16¼. | Sodium, 390½.<br>Magnesium, 27.<br>Calcium, 14½.<br>Potassium, 4½. | Traces of Alumina. Iron.—Ecole Nat. des Mines, Paris. |

| SPRING. | CHARACTER. | CARBONATES (more or less in form of Bicarbonate. | CHLORIDES. | SULPHATE. | OTHER CONSTITUENTS AND AUTHORITY. |
|---|---|---|---|---|---|
| **Contrexéville (Pavllon)** | Alkaline. | Calcium. 3½.<br>Magnesium, ¼. | — | Calcium, 13¾.<br>Sodium. 2.<br>Magnesium, ¼. | $CO_2$ ¾; (Le Cler Spring 10).,<br>Traces of Arsenic, Chlorides, Fluorides. |
| **Ems (Kränchen)** | Alkaline Saline. | Sodium, 8½.<br>Calcium, 2.<br>Magnesium, 1¾. | Sodium, 8¾. | Potassium, ½.<br>Sodium, ¼. | $CO_2$ and traces of Alumina Barium, Iron, Manganese, Strontium, Phosphate.—Fresenius. |
| **Evian-les-bains (Cachat)** | Alkaline. | Calcium, 1¾.<br>Magnesium, ¾ | — | — | $CO_2$ and traces of Iron Magnesium, Sodium, Chloride, Nitrate, Phosphate.—Willm, Lille. |
| **Franz Josef.** | Aperient. | — | Magnesium, 14½. | Magnesium 216¼.<br>Sodium, 211.<br>Calcium, 16¼. | $CO_2$ 9¼ total.<br>Traces of Alumina, Iron.—Attfield. |
| **Friedrichshall** | Saline Aperient. | — | Sodium, 69½.<br>Magnesium, 43. | Magnesium 54½.<br>Sodium, 45½. | Municipal Chemists of Breslau. |
| **Harrogate** *vide* p **117.** | Sulphurous. | — | — | — | — |
| **Hunyadi János** | Aperient. | Calcium, 7.<br>Sodium, 6.<br>Strontium, ¼. | Sodium, 15. | Sodium, 197¼.<br>Magnesium, 195½.<br>Potassium, 1. | $CO_2$.<br>Trace of Iron.—Bunsen. |
| **Johannis** | Alkaline, Table | Calcium 6½.<br>Sodium, 3¼.<br>Magnesium, 2½. | Sodium, 9. | Sodium, ¼. | $CO_2$ (Free) 21¼.<br>Traces of Iron, Lithia, Manganese and Potash.—H Plaskuda. |

| SPRING. | CHARACTER. | CARBONATES (more or less in form of Bicarbonates). | CHLORIDES. | SULPHATES. | OTHER CONSTITUENTS AND AUTHORITY. |
|---|---|---|---|---|---|
| **Malvern** **Vide p. 119.** | Table. | | | | $CO_2$.<br>Lime, Magnesium, Sodium, Chloride, Iodide. (Total = ¾ gr. only). |
| **Marienbad (Kreuz-brunnen)** | Alkaline chalybeate. | Sodium, 15½.<br>Calcium, 8¼.<br>Magnesium, 6¾.<br>Ferrous, ½ | Sodium, 14. | Sodium, 45¼.<br>Potassium, ½. | Traces of Alumina, Lithia Manganese, Strontium.—Kersten.<br>Ferdinand's-brunnen is a little stronger in Potash and Soda Salts. |
| **Nauheim (Löwen-quelle)** | Non-aperient. Medicinal. | Calcium, 8½.<br>Magnesium, 3¼.<br>Iron, ¼. | Sodium, 16½.<br>Magnesium, ¾. | Potassium, 1¼. | $Co_2$ (Free) 20½.<br>Traces of Arsenic, Ammonia, Lithium, Manganese, Phosphate. |
| **Nauheim (Ludwigs Brunnen)** | ,, ,, | Calcium, 3¾.<br>Magnesium, ½.<br>Iron, ⅛. | Sodium, 2¾.<br>Magnesium, 1. | Potassium, ¼. | $CO_2$ (Free) 17.<br>Others, *vide supra*. |
| **Nauheim (Schwal-heim)** | ,, ,, | Calcium, 6¼.<br>Magnesium, 3.<br>Iron, ⅛. | Sodium, 11½. | Potassium, ¾. | $CO_2$ (Free) 17¼.<br>Others, *vide supra*. |
| **Nauheim Kurbrunnen** | Strong Saline Aperient. | Calcium, 11½.<br>Iron, ¼.<br>Strontium, ¼. | Sodium, 110.<br>Calcium, 9¼.<br>Potassium, 3¼.<br>Magnesium, 2¾.<br>Ammonium, ¼.<br>Lithium, ¼. | Potassium, ½. | $CO_2$ (Free) 21½.<br>Others, *vide supra*. |

| SPRING. | CHARACTER. | CARBONATES (more or less in form of Bicarbonate. | CHLORIDES. | SULPHATES. | OTHER CONSTITUENTS AND AUTHORITY. |
|---|---|---|---|---|---|
| **Nauheim (Karlsbrunnen)** | Mild Saline Aperient. | Calcium, 4¼. | Sodium, 48.<br>Calcium. 3¼.<br>Potassium, 1½.<br>Magnesium, 1. | Potassium, 6½. | $CO_2$ (Free) 14¼.<br>Others, *vide antea.* |
| **Rubinat (Llorach)** | Aperient. | — | Sodium, 18. | Sodium, 844.<br>Magnesium, 28.<br>Calcium, 17. | Traces of Alumina, etc.—Bouchardat. |
| **St. Galmier (Romaines)** | Table. | Calcium, 10.<br>Potassium, 8.<br>Magnesium, 7¼.<br>Sodium, 6. | Sodium, ¾.<br>Calcium. ⅓.<br>Magnesium, ¼. | Calcium, ⅓.<br>Magnesium, ¼.<br>Sodium, ¼. | $CO_2$ (Free) 20¼, Alkaline Silicates ⅔, Traces of Arsenic, Phosphorus and Iodine. "Badoit" and "Noel" contain about a ¼ and ⅛ respectively of total saline matter of "Romaines." |
| **Vichy** (average of the three springs). | Alkaline, Acidulated. | Sodium 2½.<br>Calcium, ¼. | Sodium, ½ | — | $CO_2$ ½.<br>Traces of Potassium, Arsenic, Boric Acid, Iron, Manganese and Magnesia. |
| **Vittel ('Grande Source')** | Sulphated Ferruginous. | Calcium, 1½.<br>Magnesium, } ¾.<br>Sodium, } | Sodium, }<br>Magnesium, } 2.<br>Potassium, } | Calcium, 4.<br>Magnesium. 3¾.<br>Sodium, 3. | Traces of Iodine, Arsenic and Iron. |

# BRITISH HEALTH RESORTS.

**Bath.** — Climate mild and equable. Mineral springs. Suitable for gout and rheumatism.

**Ben Rhydding** (*see also* **Ilkley**).—Bracing. Medicinal springs. Suitable for gout, rheumatism, &c.

**Blackpool** (Lancashire).—Very bracing. During convalescence.

**Bournemouth.**—Mild and dry. Sand and gravel soil. 100 ft. above sea level; protected from N. and E. winds by pine woods. Suits persons coming home from the tropics, and for respiratory diseases.

**Braemar.**—Mountain Health resort. Very bracing climate. Sandy and gravel soil. 1,100 feet above sea level. Suitable for neurasthenia and convalescence from influenza, etc. Season, June to Oct.

**Bridge of Allan.**—Mild and equable. Saline springs. Suitable for consumption, bronchial affections, gout, rheumatism, &c.

**Buxton.**—Highest town in the Kingdom. Thermal springs. Suitable for gout, rheumatism and paralysis.

**Channel Islands** (Jersey, Guernsey, and Alderney). — Climate fine and healthy. Even temperature. Suitable for all pulmonary troubles and neurasthenia.

**Cheltenham.**—Spring, autumn, and winter resort. Chalybeate and saline waters. Suitable for respiratory diseases.

**Clifton.**—Climate equable. Alkaline waters. Suitable for respiratory diseases, also diabetes, liver and urinary disorders.

**Cromer.**—Climate very bracing, often too cold in spring; cool in summer. Suitable for anæmia, scrofula, nervous affections, and convalescence.

**Deal.**—Very bracing, pebble beach, not fit for bathing; suitable for rest cure, nervous and chronic cases.

**Droitwich.**—Recommended for its Brine Baths, which are efficacious in rheumatic and gouty affections, congestion of liver and spleen and nervous debility. (*See* **Wychia Water.**)

**Eastbourne.**—Good sea bathing; suited for convalescents from September to January, especially for cases of scrofula and consumption.

**Exmouth.**—The old town high and windy; the new town beside the river and sea beach is more protected, mild and humid.

**Falmouth.**—A warm equable winter climate; a rival to the Riviera, and cool in summer.

**Folkestone.**—Bracing. For Analysis of Water *vide* Mineral Waters.

**Freshwater Bay.**—Isle of Wight. Southern aspect for convalescents and consumptives.—B.M.J. i./c6,990.

**Harrogate.**—Has Sulphur, Chalybeate and other Saline Springs. See Mineral Waters.

**Hastings.**—Mild, being suitable as winter resort for convalescents. Unsuitable for phthisis with hæmoptysis and chronic nervous diseases.

**Ilfracombe.**—Bracing for recovery from illness.

**Ilkley** (*see also* **Ben Rhydding**).—Bracing moorland air; good fishing; golf links; a hilly district.

**Leamington Spa.**—Equable climate. Saline Springs. Suitable for chronic liver and kidney complaints, dyspepsia and uterine congestion.

**Llandudno.**—Climate bracing and appetising; rather windy; a good place for summer health resort.

**Llandrindod Wells.**—Bracing climate. Thermal waters. Suitable for liver complaint, rheumatism, skin diseases. (*See also* **Mineral Waters.**) 700 feet above sea level.

**Malvern.**—Bracing air; equable climate. Brine and Saline Baths. Suitable in gout, rheumatism, scrofula, &c. (*See also* **Mineral Waters.**)

**Margate.**—Equable cool temperature, dry sub-soil, and a moderate altitude Suitable for convalescence and lung complaints, and especially for gland enlargements and tuberculous joints; a very bracing climate.

**Matlock Bath.**—Thermal and Mineral Springs. There is here a Fango di Battaglia (hot volcanic mud cure) installation. Suitable for rheumatic and gouty affections.

**Penzance.**—A mild, equable, warm climate, but not much shelter from winds.

**Scarborough.**—Exceedingly bracing. Moors in vicinity. Suit nervous hypochondriacal persons and those recovering from illnesses.

**Sidmouth** (Devon).—Climate particularly favourable in catarrhal, bronchial and cardiac affections. In phthisis.—B.M.J. i./06,990.

**Scilly Isles.**—Mild and humid climate, temperature varying less than at any other watering place in Britain.

**Southport** (Lancashire).—Fine sands, bracing climate, suitable for laryngeal and pulmonary diseases.

**Strathpeffer Spa.**—Strong sulphurous (4 springs, richest in sulphur compounds of any in Great Britain), also an effervescing chalybeate spring. Suitable for rheumatism, gout, liver and skin diseases.

**Torquay** (Devon).—A summer pleasure season, hot and very humid, and a warm winter season; has a mild and equable climate, the soil quickly drying. Suitable for all pulmonary complaints.

**Tunbridge Wells.**—The old town, much sheltered, lies in a warm valley, while houses on the hills around have a bracing climate.

**Ventnor and Weymouth.**—Winter health resorts. Have reputation for phthisical sufferers.

**Weston-super-Mare.**—A mild equable climate; the town sheltered by hills on the north and east: fine sand and plenty of ozone; the tide recedes a great distance.

See also 'Medical Directory'—Churchill, London—for further details.

## IRISH HEALTH RESORTS.

**Kingstown, Killiney, Greystones, Bray.**—Mild and dry, comparing with Hastings and Ventnor.

**Tramore,** in Waterford.—Magnificent sandy beach.

**Queenstown.**—A suitable winter health resort, well protected from N. and E. winds.

**Glandore, Glengariff, Parknasilla** are similar.

Sulphuretted water at **Lisdoonvarna** (5·55), **Lucan** (2·7), **Donegal** (8.29), **Ballynahinch** (3·35 Cc. per litre). These are much stronger than Harrogate water in $H_2S$.

**Mallow** (70°) is the only warm spring in Ireland.

For several others B.M.J. ii./07,1583 should be consulted.

See also 'Medical Directory'—Churchill, London—for further details.

## NOTES ON ANTISEPTIC POWER OF SOME CHEMICALS AND DISINFECTANT PREPARATIONS FOR SURGEONS' USE.

(Arranged Alphabetically.)

In 1908 we conducted some bacteriological experiments with a view to determining the relative values of acknowledged Antiseptic and Disinfectant Chemicals. For the composition of the preparations dealt with in the following notes the reader is referred to the body of the work.

The first experiments were conducted with stale Urine, 5 Cc. of each of the Solutions being infected with a drop of same. After contact for the time stated in brackets, loopfuls of the mixtures were transferred to sterile broth tubes (containing 10 Cc. approx.) and incubated. In recording our results ' U ' =organisms in this stale Urine, + means growth, and — means absence of growth in the times indicated.

We then proceeded in similar manner with an active broth culture of *Staphylococcus pyogenes aureus* (' *S* '), a similar culture of *B. typh. abdominalis* (' *T* '), then with *B. coli communis* (' *C* '), and finally with *B. anthracis* (' *A* '). *In these four instances the time of contact was uniformly 2 minutes.* In the case of the more resistant organisms only the stronger types of disinfectants were operated with.

*In the case of anthrax and typhoid it should be borne in mind that these organisms show a variable resistance to disinfecting agents—c.f.* L. i./09, 815—*but the fact did not apparently upset our experimental deductions to any extent.*

Ordinary tap water was used throughout for diluting the chemicals.

It should be noted that a small proportion of antiseptic is introduced into the broth tubes in this manner, in most cases the amount *is so minute that it can have no effect on the results.*

An examination of the literature of the subject (*c.f.* Rideal's "Disinfection and the Preservation of Food,"—from whom we have frequently quoted with the initial ' R ') shows an extraordinary variability in results as recorded in the past—this is doubtless due in great measure to differences in technique.

A disinfectant should either be soluble in water or should be capable of forming a fine emulsion with it ; it should be homogeneous in the bulk, for if it separates out on standing it is certain that under the conditions of use the point is ignored and it is probable that the disinfectant value of any one part of it is, in practice, less than that of the whole when properly mixed. All other things being equal, the finer the emulsion the greater will be the germicidal power of the disinfectant.—(Kenwood and Hewlett.)

When comparing the various capabilities of Antiseptics it should be realised that the antiseptic power of any substance is not only different for different micro-organisms but for the same micro-organism under different conditions, hence it is by no means a constant quantity. The same is true of the poisonous power of a substance. (Tunnicliffe.)

The **Ideal Disinfectant** must be capable of being used in presence of organic matter without greatly diminishing its power. It should with advantage mix with soap and water—Mercuric Chloride is, of course, precipitated. It should be innocuous to man, should be homogeneous, etc. The physical condition of the antiseptic is of great importance, *e.g.*, Trikresol 10% in emulsion was found to be equal to 30% in Solution when tested against *B. typhosus.* (Rideal, Partridge & Walker.)

See also "The Ideals for a Disinfectant."—Hewlett's Lectures, L. i./09, 741,815,889.

The disinfectant should have no corrosive action on metals. It should have high germicidal power, and not be affected markedly by heat.

In the first of these lectures a useful hint occurs as to the use of a torch flame generated by a cyclone burner, burning paraffin, similar to that used on night works, &c., for disinfecting walls, floors, &c.

These lectures are abstracted in various parts of our work; *c.f.* Formalin

*Vol. I.*, p. 110, *Vol. II.*, p. **135**; Ammonia p. **133**; Sunlight *Vol. I.*, p. 671.—B.M.J. ii./09,211 should be consulted, as also Cresylic Acid, *Vol. I.*, p. 30, *Vol. II.*, p. **1**.

A somewhat old-standing record of experiments by Miquet, on a varied assortment of bactericidal substances, may be cited here. He obtained, *inter alia*, the following *figures* as showing *the parts per* 1,000 necessary to *prevent the growth* of common micro-organisms in culture media, two days' contact being allowed.

| | | | |
|---|---|---|---|
| Mercuric Iodide ... ... | 0·025. | Essential Oils, various ... | 3 to 4. |
| Hydrogen Peroxide ... | 0·05 (?). | Arsenious Acid ... | 6. |
| Mercuric Chloride ... | 0·07 | Boric Acid ... ... | 7·5. |
| Silver Nitrate ... ... | 0.08. | Sodium Arsenate ... | 9. |
| Iodine ... ... ... | 0·25. | Sodium Salicylate ... | 10. |
| Bromine ... ... ... | 0·6. | Borax ... ... ... | 70. |
| Salicylic Acid ... ... | 1. | Alcohol . .. ... | 95. |
| Zinc Chloride ... ... | 1·9 | Potassium Iodide ... | 140. |
| Carbolic Acid ... ... | 3.2. | Potassium Chloride ... | 165. |
| Potassium Permanganate | 3·5. | Glycerin ... ... | 225. |
| | | Sodium Hyposulphite ... | 275. |

(The experiments of Koch proved Mercuric Chloride the most valuable both for killing bacteria and spores. It is particularly active in the presence of Hydrochloric Acid, *v.p.* *Vol. I.*, pp. 421, 422.)

Particular attention is drawn to the **Report of the '*Lancet*' Commission on Disinfectants** which we refer to on p. **2**.

To ***summarise*** briefly ***our Experimental Results*** we can confidently advise all the following (arranged alphabetically):—

**Acidum Carbolicum** and some of the Phenoloid bodies (*v.* p. **2**),

**Argenti Nitras**,

**Formaldehyde** (fumigation for rooms),

**Hydrargyri Cyanidum**,

**Hydrargyri et Zinci Cyanidum**,

**Hydrargyri Iodidum** (as Mercuric Potassium Iodide),

**Hydrargyri Perchloridum**,

**Hydrogenii Peroxidum**,

**Iodum**,

**Lysoform**,

**Potassii Permanganas**,

for their specific purposes.

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Acidum Benzoicum. *Generally acknowledged to be a mild antiseptic only.*

Acidum Boricum. *In no sense a disinfectant, antiseptic power low, but used in sufficient quantity it does preserve food. The figure necessary for milk preservation is variously stated; 1 in 500 is usually advised, c.f. p.* **188.** 4% *is usually employed as douche for the eyes and vagina and as mouth-wash. This strength did not kill 'U' (3 hours), also 'S' +; and 'T' +.*

**Acidum Carbolicum** (*see also Lancet and Ridcal-Walker Coefficients, p.* **2**, **3**) *Liquid Phenol* (10% *water added*) *is caustic and anæsthetic. A powerful antiseptic.* 1% *is used as vaginal injection, mouth wash and gargle. This strength is stated to kill Anthrax spores, but Government Report L.i.*/02,758, *said they withstand* 5% *for* 24 *hours. In our experiments* 1°/o *killed* '*U,*' *gave—with* '*S*' ; '*T*' – ; and '*A*' –. *Boer found that from* 1 *in* 200 *to* 1 *in* 400 *killed diphtheria, glanders, typhoid and cholera in* 2 *hours, indicating variable resistance of different organisms.—L.* i./09,815. *The activity of this disinfectant on B. coli is only slightly reduced by fæces and urine.—Hewlett,* i./09,816. *Sodium Chloride increases activity of Carbolic Acid on Anthrax spores.—L.* i./c9,818. *Alcohol diminishes activity of Carbolic Acid. Most Carbolic soaps of commerce are useless as disinfectants.—L.* i./09,818. 1% *solution requires* 90 *minutes to kill* '*S.*'—B.M.J. ii./09,213.

**Acidum Chromicum.** 1 *in* 40 *is used for ulcerated gums. This strength killed* '*U*' *rapidly, also* '*S*' – ; *and* '*T*' –

**Acidum Cinnamicum.** 2°/o *prevents growth,* 4°/o *kills bacteria.* (*R.*)

**Acidum Cresylicum.** *See Vol. I., p.* 30 *et seq., also Vol. II., p.* **1**, *et seq.*

**Acidum Formicum.** 0·5% *kills B. typhosus in* 15 *minutes.* (*R.*)

**Acidum Hydrochloricum.** *The acidity of the gastric juice probably serves as a protection against typhoid and cholera. Experiments by the late A. Macfadyen support this view.—Hewlett, L. i.*/09,743. *Boer found that from* 1 *in* 200 *to* 1 *in* 1,350 *was necessary to kill anthrax, diphtheria, glanders, typhoid and cholera organisms, indicating variable resistance of different "non-spore-bearing organisms."—L. i.*/09,815.

**Acidum Hydrocyanicum.** 0·04% *sterilises Broth.* (*R.*) *Fumigation of Trees has been practised with this acid. See Royal Horticultural Society's Journals,* 1907-8.

**Acidum Iodicum.** 1 *in* 2.500 *is deodorant and preservative.* 1 *in* 500 *is used as mouth wash and for ulcers. In our experiments* 1 *in* 2,500 (3 *hours' contact,*) *failed to kill* '*U,*' *also* '*S*' + ; *and* '*T*' +.

**Acidum Salicylicum** (*Saturated Solution* 1 *in* 500). *Antiseptic. Administered may have cumulative action. Must not be used to the eyes. Failed to kill* '*U*' (3 *hours*) *also + with* '*S*' – *with* '*T*' *and with +* '*A.*'

*This acid is only very slightly dissociated on solution, is consequently a very weak acid, and owes its bactericidal action to the entire molecule and not its ions. Sodium Salicylate, on the other hand, is largely dissociated and shows no antiseptic power.—Pharmacol,* 16.

**Acidum Sulphuricum.** 0·05% *stated to be fatal to B. choleræ after* 15 *minutes' contact.* 2 *to* 3 *Gm. of Sulphuric Acid produce an effect = to* 7 *mgr. of Mercuric Chloride.* (*R.*)

**Acidum Sulphurosum** *is much more powerful than the Sulphites.* (*They have, however, disadvantages, e.g., corrosive action, etc.*

*Formalin is easier to use as explained in our text). Gaseous sulphurous Acid was until recently much used to disinfect rooms. The gas, however, is not powerful enough to kill Anthrax spores.*

*It was found that B. coli and S. pyog. aureus were killed in 24 hours in a sealed room into which 20 ounces of* $SO_2$ *were passed. B. subtilis spores were not killed. R. mentions that a Bisulphate and Bisulphite together would be useful as they liberate* $SO_2$ *on moistening, thus:*

$NaHSO_4 + NaHSO_3 = Na_2SO_4 + H_2O + SO_2$.

$SO_2$ *has quite lost its reputation in Germany.*

*Klein says although most pathogenic organisms do not thrive in acid medium some putrefactive and zymogenic bacteria, e.g., B. subtilis, M. ureæ, will, e.g., in acid urine.*

*Our results showed - with 1% of the Off. Acid = 0·05%* $SO_2$ *by wt. with 'U' (3 hours), 'S,' and 'T,' and + with 1 in 1,000 =0·005%* $SO_2$ *in each case. We found in addition that the Off.. Acid on 'C' gave – and 'A' also –.*

**Alcohol** *in itself is seldom reliable as antiseptic—the strengths used and results vary enormously. C.f. also Ac. Carbolic and Argenti Nitras.*

**Acidum Trichloraceticum.** *In throat affections (see Text) 1 in 1 or 1 in 2 Glycerin: astringent. 1 in 4 on a tampon with endoscope in gonorrhœa has been used. Less painful than Silver Nitrate. We found a 1 in 500 solution acting 3 hours killed 'U' but 'S' + and 'T' +.*

**Alum.** *Antiseptic power of Alums and Aluminium Sulphate is only slightly greater than that of the Sulphuric Acid they contain. (R.)*

**Aluminium Chloride** 1·4 *Gm. or Potash Alum* 4·5 *Gm. are required to sterilise a litre of broth. Aluminium Chloride is midway in power between Copper Sulphate* 0·9 *Gm. and Zinc Chloride* 1·9. *Gm. (R.)*

**Ammonia.** 1·4 *Gm. per litre stated to be required to preserve broth. (R.)*

*A solution of Ammonia containing 0·5 Cc. of strong solution of Ammonia in 600 Cc. of Normal Saline killed B. typh. and B. choleræ and partially B. coli and M. pyogenes aureus in 4 hours. In the case of cholera the germicidal effect takes place in a few seconds.—Hewlett, L. i./09,743.*

**Argenti Nitras** *Lotions, Eye Drops, and Urethral Injections* 1 *in* 1,000 *up to* 1 *in* 500. *In eye work is more penetrating and active than the organic silver compounds on the market (see Text). It is a bactericide 'equal to' Mercuric Chloride. Rideal found B. Coli was killed by 0·1% after 24 hours' contact, but the same strength did not kill S. pyog. aureus. (C.f. also Vol. I., pp. 151, 152 for organic Silver Compounds compared.)*

*We found that this substance in all cases yielded excellent results. 1 in 1,000 rapidly killed 'U' also 'S' –; 'T' –; 'C' –; and 'A' –. This is probably by no means the limit in dilution.*

*Boer found that from* 1 *in* 4,000 *to* 1 *in* 20,000 *killed anthrax, glanders, diphtheria, cholera, and typhoid organisms in* 2 *hours*—i.e., *a very variable resistance by different non-spore bearing bacteria.* —*L. i.*/09,815.

*Alcohol added up to* 50% *increases its germicidal power but beyond this decreases it.*

**Arsenic.** *Arsenious Acid is only "moderately antiseptic," i.e.,* 6 *Gm. per litre stated to be necessary to prevent decomposition of broth.* (*R.*)

**Arsenic Acid.** *Very feeble antiseptic,* 125 *Gm. per litre necessary. Sodium Arsenate, however, only* 9 *Gm.* (*R.*) *The figures for arsenic compounds require further investigation.*

**Auri Cyanidum.** 1 *in* 2,000,000, *according to Koch, of* $Au(CN)_3$ *dissolved in Potassium Cyanide checks growth of B. Tuberculosis.*

**Bismuthi Subgallas** *is not a germicide. Growth of B. anthracis is not affected in any way.* (*R.*)

**Borates and Boric Acid.** *See Acidum Boricum.*

**Bromum** *was found by Arbourg and confirmed by Koch, to be the most powerful of all destructives to Anthrax and Tubercle bacteria. Our results showed that it is undoubtedly most powerful.* 1% *killed 'U' rapidly, and* 1 *in* 400 *with 'S' gave – and same strength with 'T' gave also –.*

**Calcii Hydras** (*Slaked Lime*) *is not an antiseptic of any note.*

**Calcii Permanganas.** *See Potassii Permanganas.*

**Calcii Sulphas.** *Deodorant but not disinfectant.* (*R.*)

**Carbon Bisulphide.** *Antiseptic, but odour and inflammability prevents its use.*

**Carbon Dioxide,** *e.g., in Aerated Waters, has been found to have remarkable power in killing typhoid, cholera, anthrax bacilli, and Staphylococcus, but* not *anthrax spores.* (*R.*)

***Chinosol.** *A soap containing* 5% *Chinosol inferior to one made with* 0·5% *Mercuric Biniodide.* (*R.*)

**Chlorine.** *A cold saturated solution of Chlorine Water contains* 0·634% *by weight. Intimate contact of the halogen with the centre of infection is essential.* (*R.*) *The halogens are active in proportion to their atomic weights.*

*It is satisfactory to note that 'Chlorine Gargle,' which contains about* 0·125%, *rapidly killed 'U'; we also obtained with 'S' – and 'T' –.*

*Suitable for treating drinking water. No potable water would be likely to contain more than a small fraction of the number of cholera vibrios introduced into different waters used experimentally in the investigation in question (ranging from about* 1,000 *to* 18,000 *per* Cc.). *It was concluded that most waters would be freed from cholera vibrios, if treated with* 1 *of chlorine per million for* 15 *minutes.—L.ii.*/10,1213.

**Chloroform.** *Our experiments showed* 1 *in* 500 *did not kill 'U'* 8 *hours), nor 'S'* +, *nor 'T'* +.

**Chromates and Bichromates** *should not be used (to wounds) as they are poisonous.* 1 *in* 100,000 *was in the past employed as preservative.*

**Copper Salts** *rank next to Mercurials.* (*R.*) *v. infra.*

**Creolin Pearson** *contains* 20% *Cresols, c.f. Liquor Cresol Saponatus.*

**Creosote (Morson).** 1 *in* 150 *is used in phthisis, &c., see text. Said to be more powerful than Phenol. This strength 'acting'* 3 *hours we found killed 'U,' also 'S,' and 'T.'*

**Cupric Chloride.** 5°/o *kills most organisms after two hours, but weaker solutions only retard.* (*R.*)
*Kraemer has advised for treating water (c.f. Text)* 1 *in* 5,000.

**Cuprous Chloride** *is stated to kill B. typhosus also B. coli in an hour, and to be stronger than the Sulphate, c.f. Vol. I., p.* 337.

**Cupri Sulphas.** 1°/o *Disinfectant,* 0·1°/o *Antiseptic, c.f. Vol. I., p.* 337. 1% *is used for irrigation, see Text, ibid.*

***Cyllin.** *Wound Lotion* 0·5%. *Douche* 0·25%. *A powerful antiseptic in these proportions. We subjected to a more stringent test, viz.,* 1 *in* 4,000. *This killed 'U' (*3 *hours), giving –, also killed 'S' and 'T' but did not kill 'C' or 'A' in same time, i.e.* 2 *mins).*
5% *is more active than* 4·7% *Phenol on M. pyogenes aureus in pus.* —*L. i.*/09,816.

**Ethyl Iodide.** *Readily destroys B. Tuberculosis.* (*R.*)

**Fluorine.** *More active than Chlorine. Fluorides and Silicofluorides (c.f. Salufer) are antiseptic. Sodium Fluoride* 0·4°/o *is fatal to Micrococcus Prodigiosus. Fluoric Acid and Ammonium, Potassium and Sodium Fluorides are used in the brewing trade.* 0·3% *will prevent the acidity of butter, and in a trial found not to be injurious to health.* (*R*).

**Formaldehyde** *said to be more powerful than Mercuric Chloride, but the usual strength for use seems to be about* 1% *to* 2%. *This is suitable for wounds, hands, instruments and room disinfection.* ½% *said to kill most organisms. We tried* 1% *of the* 40% *article of commerce (*3 *hours) on 'U' and obtained +, also + with 'S,' – with 'T' and – with 'C.' The results were not altogether accordant. In one experiment we obtained + with* 2% *on 'C.'—A writer in* B.M.J.E. ii./08,7, *found this to be killed in* 60 *minutes. (c.f. Vol. I., p.* 110 .
*Rideal states Formaldehyde is 'among the first three or four antiseptics.' Even when the proportion is too small to prevent growths development of the organisms is long postponed. His experiments showed that* 1% *(of actual Formaldehyde) kills S. pyog. aur. after* 50 *to* 60 *minutes' contact, B. Typhosus* 40 *to* 50 *minutes, B. Coli* 30 *to* 40 *minutes, B. Anthracis and S. Choleræ after less than* 50 *minutes. See also p.* **188**.
10% *Solution most useful for deodorising. Use as milk preservative in Great Britain now forbidden, v.p.* **188** *et seq.*

*Hewlett*, L.i/09,744., *says Formaldehyde is probably more active than Sulphurous Acid in general disinfection.*

**Guaiacol** *is stated to have greater bactericidal power than Phenol, i.e., as* 5 : 2.

**Glycerin** *is preservative for vegetable preparations (c.f. Glycetracta), but, as anticipated, our experiments gave + with pathogenic organisms.*

**Hermite** *is practically a dilute solution of Hypochlorous Acid, prepared by electrolysis of the Magnesium Chloride of sea water. Kills diphtheria, cholera and typhoid bacilli in* 5 *to* 10 *minutes, and Anthrax spores in* 1 *hour.* (*R.*) *c.f.* also L. i./08,157 *and pp.* **77, 78.**

**Hydrargyri Cyanidum.** 1 *in* 15,000 *is said to be sufficient. We should prefer* 1 *in* 5,000 *at least. As gargle* 1 *in* 10,000 *is used. For fibroid rhinitis tampons impregnated with* 1 *in* 2,500 *have been employed (c.f. Text). It is extremely poisonous. We found that* 1 *in* 10,000 *acting* 2 *minutes did not kill 'U,' but killed 'S' and 'T' in the same time.*

**Hydrargyri Ethylen-diamin-sulphas.** *As vaginal douche and hand disinfectant 'non-irritant'* 1 *in* 2,000 *to* 1 *in* 1,000 *employed. We obtained + with 'U' acting* 2 *minutes with* 1 *in* 2,000 *solution, but – with* 1 *in* 1,000, *also + with* 1 *in* 1,000 *on 'S.' – with same on 'T,' 'C' and 'A'* (= **Sublamin**).

**Hydrargyri et Zinci Cyanidum.** *As first dressing to wounds* 3% *gauze and wool,* 33% *paste used (q.v.) non-irritant. We found a minute or two with the paste sufficed to kill 'U,' also 'S' and 'T.'*

**Hydrargyri Iodidum Rubrum.** *Is insoluble in water, but is used as Mercuric Potassium Iodide. For hands* 1 *in* 4,000, *Collyrium* 1 *in* 5,000, *wounds* 1 *in* 7,000, *vaginal douche* 1 *in* 10,000. *Not so irritant as the Perchloride. We found even* 1 *in* 100,000 *active on 'T' but not on 'S,' also killed 'C' and 'A.'*

**Hydrargyri Oxycyanidum.** *As pigment in syphilis* 0·2 *to* 0·6 %. *We found* 1 *in* 1,000 *killed 'U,' also 'T,' but not 'S.'*

**Hydrargyri Perchloridum** *is the most powerful antiseptic known. Its intensity is increased by presence of Hydrochloric Acid, e.g.,* 1 *in* 500 *with* 1 *in* 120 *of acid, for disinfecting excreta. It is precipitated by soluble organic matter. For eye, nose and mouth lotion* 1 *in* 4,500, *vagina* 1 *in* 10,000. *For linen, rooms, gynæcologists' hands and superficial wounds* 1 *in* 10,000 *to* 1 *in* 1,000. 0·07 *Gm. stated to be necessary to prevent growth in a litre of broth* (1 *in* 14,300 *approx.*) : *this is an over-estimate.* (*R.*) *The minimum for disinfection (Woodhead) should be* 1 *in* 500, *preferably with about* ½% *Hydrochloric Acid added. Utility of this for B. Tuberculosis is doubted. Our experiments show power of in* 100,000 *solution : this rapidly killed 'U,' also 'S,' 'T,' 'C' and 'A'* (2 *mins. each*), *c.f, also Vol. I., pp.* 421, 422.

*Paul and Krönig showed that of Equimolecular Solutions of this salt, the bromide and the cyanide, the antiseptic power (on B. Anthracis Spores) was in this order—corresponding to the degree of* *dissociation in the three solutions.—Pharmacol, p.* 15. *c.f. a recent investigation of ours, Vol. I., p.* 421.

*A little Hydrogen Sulphide should be added to subcultures in testing power of this substance to prevent the sublimate carried over with the bacteria from interfering with results.*—L. i./09,815.

*Sodium Chloride reduces power on anthrax spores.*—L. i./09,818.

**Hydrogen Peroxide** *is variously employed: even the strong official solution may be employed on mucous membrane. In otitis* 10 *to* 15%. *In diphtheritic conjunctivitis, also stomatitis* 3%, *cystitis* 1 *to* 3%. *In chronic gonorrhœa* ½ *to* 1%. *It has been stated* 1 *per* 1,000 *destroys cholera and typhoid bacilli in* 24 *hours (experiments with water purposely infected). Suggestion was made to disinfect water for domestic use by adding* 10 *Cc. of* 10% *solution to the litre of water. It is used in the Budde process of sterilising milk (q.v.) and is contained in Sanitas q.v. Our results proved that even in* 2% *dilution the official Hydrogen Peroxide Solution is an active germicide, i.e., killed 'U' after short contact, and 'T' after* 2 *minutes, but not 'S.'*

*Bacteriologists refuse to credit this chemical with any true antiseptic power—maintaining action due to the minute bubbles of oxygen which are given off mechanically in presence of pus or other decaying matter.—Hospital, April 4, '08. This we cannot quite agree with. We certainly found it most active in above experiments.*

**Iodine** *is used to sterilise catgut (q.v.). The solution is efficient. We tried* 1% *and found it to kill 'U,' also 'S' and 'T.' In the proportion of* 7 *in* 1,000,000 *of liquid has been stated to kill B. Anthracis.* 1 *in* 10,000 *destroyed Sarcina lutea in half an hour, but, unfortunately, to check B. Anthracis once established in the human body* 12 *Gm. of Iodine would have to be in constant circulation in the system. (Koch.)*

**Iodine Trichloride** 5 *in* 100,000 *killed B. Typhosus in half an hour. (R.)*

**Iodoform** *is used as a bladder injection with glycerin also, as a dusting powder and wool dressing. The activity of this as an antiseptic has been doubted. In our experiments the results with Iodoform were satisfactory, although the test was applied in a drastic manner, i.e., a paste of it killed 'U' in a few minutes, also 'T,' but 'S' gave +.*

**Iron.** *Frankland proved that Metallic Iron is destructive to bacteria.* **Ferrous Sulphate** 1% *is antiseptic but not disinfectant.* **Ferric Sulphate** *and* **Chloride** *check fermentation and bacterial growth.*

✶**Izal** *is described at length by Rideal. See also Klein, B.M.J.* ii/04,13. *and our Vol. I., p.* 33 *and Vol. II., p.* **3**, *et seq.*

**Lead Salts.** *Strongly antiseptic: next to Zinc Chloride.* 2·0 *Gm. per litre of broth required. Dangerous as antiseptic on account of absorption. (R.)*

**Liquor Carbonis Detergens.** *A remedy in skin affections, strength used 1 in 8 up to 1 in 160 (see Text). We found 2% solution killed 'U' (3 hours), also 'T,' 'C' and 'A.' It inhibited 'S' but did not kill.*

**Liquor Cresolis Saponatus, U.S.** *For midwifery 1% usually employed. Is stated to be 1½ times as active as Liquid Phenol. We found 1% acting 10 mins. killed 'U,' but 1 in 5,000 did not, similarly 'T,' but 1% did not kill 'S.'*

**Lister's Antiseptic.** *See* **Hydrargyri et Zinci Cyanidum.**

**✶Lysoform.** *This is employed for wounds and irrigation. Contains Formaldehyde. Lathers with water. 2% kills 'U,' also 'S' and 'A,' but at least 10% is necessary for 'T' and 'C.' Non-poisonous. For further details v. Vol. I., p.* 113, *Vol. II., p.* **3**.

**✶Lysol.** *In gynæcology 1% is used. We found 1 in 300 killed 'U,' also 'S,' 'T,' 'C' and 'A.' For further details v. Vol. I., p.* 33, *Vol. II., p.* **3**, *et seq.*

**Manganates.** *Sodium Manganate (impure) with some Permanganate and Chloride constitutes Condy's Green Fluid. (R.)*

**Mercuric Chloride.** *See* **Hydrargyri Chloridum.**

**Mercuric Cyanide.** *See* **Hydrargyri Cyanidum.**

**Mercury Vapour Lamp** *is bactericidal, e.g. to B. prodigiosus.*

**Naphthalene.** *Enemata of 8 grains have been used (see Text). Parasitic in scabies, 10 to 20% solution in oil. Is commonly employed as deodorant in closets, but not a disinfectant in this way. Employing a paste we obtained + with 'U' (3 hours), also 'S' +, but 'T' −.*

**Naphthol β.**—*Oily Solution 10% has been used. This appears to be active. We obtained − with a paste in the case of 'U' (3 hours), also − with 'S' and 'T' −.*

**Oils Essential.** *See Vol. I., pp.* 551, 552; *Vol. II., pp.* **58**, **59**.

**Oxygen** *in the nascent condition, e.g., from Potassium Permanganate, is more powerful than atmospheric oxygen.*

**Ozone** *in the dry state has little action on micro-organisms.*

**✶Paraform.** *The spontaneous vapour (Formaldehyde) is useful to maintain instruments and catheters in sterile condition. For fumigation of rooms during and after disease. Tablets (15 grains) are made. 20 of these disinfect 1,000 cubic foot space thoroughly. Using a paste with water we found to kill 'U' rapidly, also 'S' and 'T' in 2 mins.*

**Persulphates** *are Antiseptic.* **Ammonium Persulphate.** 1 *to 2% kills Cholera organisms and others in a few minutes.* **Sodium Persulphate** 0·2% *is fatal to Sp. Choleræ.*

**Phenoloid Disinfectant.** *v. Vol. I., p.* 34.

**Phosphates, Acid.** *Said to be of value as bactericides. Calcium Acid Phosphate 1 in 1,000 was tried. (R.)*

**Potassium Hydroxide** *is equal to Sodium Hydroxide q.v.*

**Potassium Permanganate** *is best employed in strong solution.* 1 *in* 125 *prevents growth. It is a good deodorant.* (*R.*) *Our experiments showed the Permanganates on the whole to be satisfactory. We found* 1 *in* 100,000 *of Potassium Permanganate no avail on any of the organisms, but* 1 *in* 1,000 *killed all of them rapidly* : *'U,' 'S,' 'T,' 'C' and 'A.'* **Calcium Permanganate** *is stated to be stronger than the Potash Salt.* 1 *in* 100,000 *should sterilise water in* 5 *mins. We did not find this strength to kill either 'U,' 'S,' or 'T,' but* 1 *in* 5,000 *killed 'U,' 'S,' 'T' and 'O'* (*not tried on 'A'*).

*In gonorrhœa* 1 *in* 1,000 *gargle and vaginal douche* 1 *in* 5,000 *of either salt are employed.*

*Tested in the ordinary way shows a very high Carbolic coefficient, but in presence of organic matter its power is reduced by it oxidising the organic material.—B.M.J. ii./09,*212.

"*Potassium Permanganate* 10% *practically useless on organisms in pus.*"—*L i./09,*816. *But c.f. Bousfield's results. Vol. I., p.* 507.

**Pyoktanin.** 1 *in* 500 *or even* 1 *in* 2,000 *arrests B. typhosus and B. coli.* (*R.*)

**Pyrogallol.** 3% *kills most organisms.* (*R.*)

**Quinine Sulphate** 1 *in* 500 *Solution necessary for killing infective organisms* (*in a common cold*).—*L. ii./08,*1661. *See also Quinine Sulphate.*

**Resorcin** *is sufficiently antiseptic in* 1% *solution to kill most organisms.* (*R.*) *Is non-irritant on mucous membrane,* e.g. *bladder,* 5% *is used. As collyrium* $2^{\circ}/_{0}$, *as enema* $0{\cdot}5^{\circ}/_{0}$. *See also Text.* 1 *in* 5,000 *did not kill 'U'* (10 *mins.*), *nor 'S,' nor 'T.'*

**Soap.** *Though not giving a high Carbolic coefficient is generally acknowledged to be germicidal. We tried a* 2% *solution which was useless on 'U,' 'T,' 'S' and 'C' but this did not simulate the process of scrubbing or washing, which is well known to be effectual. c.f. for further details p.* **76**.

**Sodium Hydroxide.** 2% *to* 5% *exercises an influence on bacterial growth, as also the* **Carbonate** 5 *to* $10^{\circ}/_{0}$. **Bicarbonate** *is hardly antiseptic.* **Sodium Chloride** *is not a disinfectant, though largely used for meat.* (*R.*)

**Sodii Metabisulphis.** *Said to be a strong antiseptic. A pigment* 10 *grains to the ounce of glycerin has been used for thrush. We found this to kill 'S,' but not to kill 'U' or 'T'* (2 *mins. all*).

**Sodii Sulphas Acida.** *For water sterilising see Text.* 1 *Antityphoid Tablet to the pint of water stated to destroy 'T' and B. enteritidis in* 15 *mins. We found it killed 'T' and 'S' in* 2 *mins. in above proportion.*

**Sodii Sulphis.** *Made use of in the 'Warwick Air Purifier' with glycerin to 'catch' the organisms* (*see Text*). 1 *in* 500 *we found of little avail, giving + with 'U'* (10 *mins.*) *also with 'S' and 'T.'*

★**Sublamin.** *See* **Hydrargyri Ethylen-Diamine-Sulphas.**

**Tar.** *See Liquor Carbonis.*

**Terpineol.** 1% *is stated to prevent growth of Anthrax and* 10% *to kill Staphylococci in* 10 *mins.*

**Terpin Hydrate.** 0·25% *said to arrest Tubercle Bacilli.*

**Thymol** *arrests fermentation better than Phenol.* (*R.*) 1 *in* 800 *is used as gargle. It is soluble* 1 *in* 1,500 *water and* 1 *in* 200 *glycerin. We found* 1 *in* 1,000 *killed ' T' and ' C,' but not ' U' or ' S.'*
' 1% ' (*? what used to dissolve*) *was found to kill ' S' in* 3 *minutes.* 0·5% *killed it in* 5 *minutes.—B.M.J. ii./09,213.*

**Thymol Disinfectant.** *Vide Vol. I.*, p. 771.

**Toluol** (*c.f. Benzol, which it resembles*). *Did not hinder ' U' or ' S.'*

**Trikresol.** *In general surgery* ½ *to* 1%. *Said to be more powerful than Phenol. Eye wash* 1 *in* 1,000 *to* 1 *in* 2,000. *Experiments with* 1 *in* 2,000 *gave with ' U'* (10 *mins.*) +. *It appeared to hinder ' S' and ' T,' which ultimately developed* (*in* 60 *hours*). ½% *on the other hand killed ' U,' ' T' and ' C,' but not ' S.'*

**Zinc** *shaken with water stated to kill B. typhosus and B. coli communis in a few hours. Copper has a similar effect.* (*Kræmer.*

**Zinci Chloridum.** 1 *in* 500 *is an astringent lotion. It is very poisonous. Ranks below Mercuric Chloride and Copper Sulphate. A* 2½% *Solution was found to destroy bacteria, but Koch found even* 5% *would not kill Anthrax spores.* 1·9 *Gm. stated to be necessary to prevent growth in a litre of broth. The results of our tests showed that Zinc Chloride was not of much avail.* 1 *in* 1,000 *failed to kill ' U'* (3 *hours*) *and ' S' and ' T.'*

**Zinci Permanganas.** *Employed similarly to the Potash Salt. Absence of irritation is a feature.* 1 *in* 5,000 *did not kill ' U'* (10 *mins.*) *but prevented growth of ' S' and ' T.'*

**Zinci Suphanilas.** 1 *in* 500 *to* 1 *in* 250 *is used in gonorrhœa. Experiments showed with* 1 *in* 100 *' U'* (2 *mins.*) –, *the same with ' S,' but* + *with ' T' and ' C,' also* + *with* 1 *in* 250 *on ' U'* (2 *mins.*) – *in case of ' S,' and* + *with both ' T' and ' C.'*

**Zinci Sulphas.** *No value as germicide.* (*Koch, Klein, etc.*) *Our experiments show that Zinc Sulphate, even* 1 *in* 500, *is of no use, the* + *is very marked all through* (*with ' U,' ' S' and ' T'*).

**Zinci Sulphocarbolas.** *Said to be a ' Strong Antiseptic.' Our results showed the action of this substance to be only slight.* 1 *in* 200 *did not kill ' U,' ' S,' ' T' or ' C.'*
*These results form an interesting Table vide Vol. I.*, p. 974.

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**Sunlight** *according to Koch will kill the Tubercle Bacillus in from a few minutes to* 5 *or* 7 *days, according to the thickness of the medium. Light, in short, is one of the most important agencies for diminishing the number of bacteria.*

*B. typhosus is killed rapidly by sunlight.* 240,000 *organisms in* 2 *hours were reduced to nil* (*in India*).—*L. i./09,742.*

**Heat** *owes its bactericidal power to its coagulating effect on bacterial proteins. Moist heat is best because apart from its penetrating power it is well-known the protein in the dry condition coagulates at a much higher temperature than when moist.*—Hewlett L. i./09,815.

**Filters.** *The 'Pasteur-Chamberland' or 'Berkfeld,' or similar apparatus of the porous candle type are efficient instruments.*

# ANALYTICAL MEMORANDA.

## I.—CHEMICAL TESTS & MICROSCOPIC METHODS FOR THE EXAMINATION OF URINE, BLOOD, FÆCES, &c.

The **Specific Gravity** of Urine (at 60° F.) is usually between 1·015 to 1·025. The **volume passed per diem** (24 hours) in health is about 50 ounces (1,500 Cc.). The capacity of the bladder is, as an average, 20 ounces (600 Cc.).

It is pointed out that temperature makes a considerable difference in taking the Sp. Gr., *e.g.*, a urine Sp. Gr. 1·015 when passed may be 1·020 when cooled to room temperature. The specific gravity increases about one point for every fall of 8° F. of temperature.—L. i./07,252.

In women the Sp. Gr. frequently ranges higher than in men. 1·035 to 1·040 is not at all uncommon even in health and not entirely accounted for by small consumption of liquid.—B.M.J. ii./09,652.

### Acetone and Allied Bodies in Urine.

**Legal's Test**:—

*Fresh* concentrated **Sodium Nitroprusside** $[Na_4Fe_2(CN)_{10}(NO)_2 + 4H_2O = 592{\cdot}38 (595{\cdot}864 \text{ I.Wts.})]$ **Solution** (soluble 1 in 2½) added to a specimen or its distillate containing Acetone, made slightly alkaline with caustic potash, produces a red colour which changes rapidly to yellow. On adding Acetic Acid a reddish-violet colour is produced, which changes to blue on standing.

Ammonia to alkalise in place of Liquor Potassæ is recommended, and do not use Acetic Acid. Proceed thus—Add a little Ammonia so that it remains on top as a clear solution with the nitroprusside and urine below. If acetone is present in 1 to 3 minutes a well marked ring of magenta (petunia) appears at the juncture of the liquids and spreads upwards. An orange-red ring is to be distinguished from the acetone ring.—L. i./07,805.

Lange uses 15 Cc. Urine, ½ to 1 Cc. of Glacial Acetic Acid, a drop of freshly made Nitroprusside Solution and 1 Cc. of strong Ammonia Solution by which 1/400th % can be detected.—Cammidge, L. i./07,911.

Acetone having a specific gravity of 0·8 will obviously decrease the specific gravity of a urine, and may lead to error if its presence be unsuspected in diabetic urine. This is apt to occur in an advanced stage of the disease.

Acetonuria in cases of gastric ulcer.—L. i./03,1230.

May be associated with the administration of chloroform.—L. ii./05,583.

**Lieben's Test.** Distil the sample and make distillate alkaline with potash, add a little iodine solution (not an alcoholic solution). The formation of iodoform, recognised by yellow turbidity and the odour, indicates presence of acetone.

Examine the Iodoform crystals microscopically; the test by the smell is not much use.—L i./07,805.

**Diacetic Acid,** $CH_3.CO.CH_2.COOH = 101{\cdot}28$ ($102{\cdot}048$ I Wts.)
**Gerhardt's Test for.** Ferric Chloride gives red colouration. A few drops

of Potassium Citrate solution instantly removes the colour. Reacts also with Sodium Nitroprusside as above but less reliable. The acid is soluble in ether, and may be removed by it after acidifying the specimen with Sulphuric Acid. Dilute Ferric Chloride solution shaken with this ethereal solution, becomes red.

Occurs in urine in cases of gastric ulcer.

In employing the ferric chloride test care must be taken to distinguish from colour produced by salicylic acid and compounds, *e.g.*, salicin, aspirin, diuretin, salol.

Boil the urine first for five minutes, then apply test. As the diacetic acid is converted by so doing into acetone there is considerable reduction in colour if dependent on diacetic acid, but is unaltered if due to salicylic acid.—B. M. J. ii./04,114 ; L. i./07,511.

In diabetes the ferric chloride reaction in urine indicates by the colour produced the amount of diacetic acid present and is hence measure of the acidosis when of mild degree. The $\beta$-oxybutyric acid, which cannot be conveniently tested for, is roughly proportional to the diacetic acid present. Coma is always accompanied by a deep reaction of the urine with ferric chloride. The appearance of the reaction indicates that a benign case of diabetes has become a severe one, and that the tissue metabolism has become profoundly altered. It is important to keep a close watch on this test, both as to its presence or absence, and also as to the depth of colour obtained. In early stages patient may be still amenable to treatment. A direct change to a strict carbohydrate free diet is unnecessary and dangerous as it often gives rise to a ferric chloride reaction when none is present or increases one already existing. Gradual reduction is just as efficacious.—L. i/10,1002.

**Iodic Acid Test for.**—Add to 1 or 2 Cc. of normal urine 2 Cc. of 10°/₀ Iodic Acid Solution and 3 Cc. Chloroform. Uric Acid, etc., reduce the Iodic Acid —the Chloroform becoming coloured with the Iodine. Now add a little of the specimen to be tested and shake thoroughly. If Diacetic Acid (Aceto-Acetic Acid) present the colour disappears, if absent it is intensified.—M. 1906.

**Hydroxy- or $\beta$-Oxy-Butyric Acid** $CH_3.CHOH.CH_2COOH = 103{\cdot}28$ (104·064 I. Wts.), and any increase in the amount of fat (lipæmia—granules stained by Osmic Acid), should be carefully looked for in the urine and blood respectively of diabetics. It may be extracted from the specimen with ether, and gives a reddish-violet colour with Ferric Chloride *vide* above—the diacetic acid gives approximate index of this acid. Occurs only if Diacetic Acid be also present, *c.f.*—B.M.J.E. i./06,49. The specimen may be fermented to remove sugar, precipitated with lead acetate and ammonia ; if the filtrate be lævorotatory $\beta$-Oxy-Butyric Acid is probably present.—B.M.J. i./03,1205.

In diabetes, Acetone, Diacetic Acid and $\beta$ Oxy-Butyric Acid are excreted in this order as the disease advances, and if metabolism can be improved they disappear in the inverse order. The main source of Acetone is the imperfect metabolism of fat, either of food or the body.—B.M.J.E. ii./06,49. *c.f.* p. **143** *et seq.*

In some of the gravest forms of renal disease albumin may be absent from the urine, at any rate temporarily. An address on diagnosis of certain forms of renal disease. —B.M.J. i./07,725. Conversely serious renal disease should not be diagnosed merely by finding blood or albumin in the urine.

In following the progress of a case it is of importance to examine the mixed urine of a whole day, because if, *e.g.*, the percentage in a specimen examined were to suddenly show a rise, the quantity excreted per diem might be the same if the amount of urine, had decreased owing to the consumption of less liquid, or change of diet, occupation, &c., and *vice versa.* The same remark, of course, applies to all pathological constituents in the urine.

With regard to the various views as to reasons for appearance of **$\beta$Oxy-Butyric Acid, Diacetic Acid and Acetone** in the Urine, Mann says the tendency at the present time, is to consider them as products which are found during the splitting up of fat in the tissues generally,—according to some authorities in the muscles and large glands particularly, such as the liver.

Occurrence of acetonuria in infectious diseases. By Acetone bodies are meant $\beta$-Oxybutyric and Diacetic Acids and Acetone. Acetone occurs much more constantly in diphtheria and scarlet fever than in enteric, of 96 cases of diphtheria 87 were found to have acetonuria and of 197 cases of scarlet fever 167 showed its presence also.—L. i./10,1346.

**Acidosis**—B.M.A. Discussion.

It is known that the organism normally meets the presence of Acids in the system by using an available alkali that is not essential for other purposes, namely Ammonia. Those animals that have from their food considerable Ammonia available have the greatest power of withstanding Acid intoxication and *vice versa.* As a consequence Ammonia is excreted in abnormally large amounts in the urine and the presence of Ammonia in same in abnormal amounts becomes an index of the acid intoxication. In human beings similar circumstances maintain in certain pathological conditions. $\beta$-Oxybutyric Acid is the only acid known to occur in the body in amounts sufficient in themselves to be dangerous from the effects as Acid. Acetone and Diacetic Acid are oxidation products of this acid. Diacetic Acid is not directly toxic. Acetone probably occurs only in very small amounts,—it may have but a small direct share in any severe toxæmia, but it may perhaps damage the kidneys, thus tending to add renal insufficiency to the pre-existing toxæmia. The administration of alkalis often does good. $\beta$-Oxybutyric Acid has a large share in producing the intoxication that occurs in diabetes, but Acid intoxication does not wholly explain the conditions. Acidosis relatively slight is also seen in starvation. Various poisonings, especially some of the narcotics, in digestive disturbances, in cyclic and periodic vomiting, in acute yellow atrophy and phosphorus poisoning, in eclampsia and vomiting of pregnancy. The occurrence in diabetes is known to be dependent on inability to use Carbohydrates, and coincident excessive uses of fats. In starvation large amounts of body fat are burned.

The Author suggests the possibility that the attack of the Organic Acids may in more or less extent be upon the lipoids of the nervous system and resemble that of narcotics, others show that the acids may act in part as narcotics through the influence of the undissociated molecules upon the lipoids. With regard to the manner in which $\beta$-Oxybutyric Acid accumulates rather than Diacetic Acid or Acetone, it appears that a definite equilibrium is maintained between the two acids. Probably normally the oxidation does not go over to Diacetic Acid.

Various substances have been suggested to control acidosis,—*Alcohol has proved of most value.* Lately Woodyat has found that Glyceric Aldehyde largely reduces acidosis,—it is probably a normal combustion product of sugar. The best control must for the present be to gradually train the Carbohydrate metabolism back to the point where it can utilise more Carbohydrate and thus do away with the acid intoxication.—D. L. Edsall, B.M.J. ii./10,1033.

In the discussion on this paper the dietetic treatment of diabetes was dwelt on. A diabetic may be able to metabolise lævulose, oatmeal or potato starch when unable to assimilate other Carbohydrates. In other forms of acidosis dextrose is given,—if necessary per rectum. The subject of acidosis in delayed Chloroform poisoning is also discussed.—B.M.J. ii./10,1036, *et seq.*

The presence of acetonæmia in diabetes is caused by Aceto-acetic Acid decomposing. This in turn is formed from β-Oxybutyric Acid,—in grave cases 30, 50, or even 70 Gm. of this acid may be excreted in the course of 24 hours. A diabetic may die with some of the symptoms usually associated with coma, although he has little β-Oxybutyric Acid in his blood, but it is generally accepted that the characteristic air, hunger and coma, which follow upon it, are actually due to acidosis.—A. E. Garrod. B.M.J. i./11,1416.

Phthisis and diabetes frequently occur in the same family. The former is decreasing, the latter is on the increase. Is it due to open air treatment with its forced appetite? Are we trying to strengthen relatives of phthisical patients and over-straining their powers of metabolism? Is there any significance in the appearance of β-Oxybutyric Acid in diabetes and the absence of sweating?—B.M.J. i./10,1006.

*To combat acidosis in diabetics with large quantities of glucose seems more scientific and more likely to give benefit than alkalis,—this tackles the condition nearer its source than attempting to neutralise an already fully neutralised series of Acids*, which are probably of no more importance than some of the other known chemical abnormalities, *e.g.*, the presence of Creatin,—which accompany this condition. The term acid intoxication applied to gastro-enteritis, delayed Chloroform poisoning, etc., is a misnomer. The amounts excreted in these conditions is small in comparison with that in diabetic coma, and are thought not able to produce symptoms.—L. ii./11,10.

## Albumin Tests.

**Proteins** occurring in urine are classed by Mann as—

(*a*) **Serum Proteins**: *Serum albumin*, *Serum globulin* or *paraglobulin* and *fibrin*.

(*b*) **Compound proteins**: *Nucleo-albumin*, *Chondro-albumin*, *Taurochol-albumin* and *Mucins*.

(*c*) **Proteolytic products**: *Albumoses*.

Secondary Albumoses excepted, all the urinary proteins are precipitated by Nitric Acid. With most, excepting Albumin, the precipitate thus formed is *soluble with heat*.

Albuminuria denotes the presence in the urine of Serum Albumin accompanied by varying proportion of **Globulin**.

Albumin is precipitated by excess of mineral acid, but not by Acetic Acid.

**Acetic Acid with heat.** Fill a test tube about half full with filtered urine, slightly acidify with dilute acetic acid. Boil the upper portion. Albumin, if present, will precipitate in the form of a cloud which will be insoluble after cooling on further addition of acetic or nitric acids in moderate amount.

### Differential Diagnosis in cases of Albuminuria.

*The presence of Albumen seldom matters until its amount is sufficient to respond both to the Acetic Acid and boiling test, and the Cold Nitric Acid Test,—there is no need to trouble about the other Albumen tests,—there is such a thing as too great delicacy for clinical work.*

In doing the Acetic Acid and boiling test it is well to add a few drops of the Acetic Acid to the opalescence if formed, *i.e.*, after boiling unless the urine be alkaline to start with, in which case it must be rendered slightly acid before being boiled. If the cloud formed disappears it is Calcium or Magnesium Phosphate, if it dissolves with effervescence it is carbonate,—if it remains unaltered or becomes thicker (flocculent) it is Albumen.

A fallacy is with regard to **Nucleo-proteid**,—this is precipitated by Acetic Acid, and it is possible for a cloud of Phosphates to be cleared up by the latter, and yet for a faint cloud of nucleo-proteid to come down in the place of the phosphates in such a way as to suggest that the original cloud was not wholly soluble in the acid, and therefore that albumen is present when it is not. There are three ways of obviating this source of fallacy; the *first* is to add a single drop of dilute nitric acid to the suspicious cloud that remains after the addition of acetic acid; if it is due to albumen, it will persist or even increase, whilst if it is due to neuclo-proteid the nitric acid will disperse it: the *second* is to perform the cold nitric acid test for albumen as described subsequently—nucleo-proteid will not give a definite localised white ring with it; and *thirdly*, a control test may be done, acetic acid being added to another specimen of the urine without boiling, and the cloud due to any nucleo-proteid present compared with the cloud in the acidulated and boiled specimen.—Herbert French, B.M.J. i./11,417.

**Clinical Significance of Albuminuria.**—The amount of albumin detected at any time does not measure the importance of the albuminuria. A large output naturally implies failure of nutrition, but a small quantity may be of equal danger. Note Sp. Gr. and color.

The finding of Casts may be of assistance, but too much importance need not be paid to presence of a few hyaline casts (especially in centrifugalised sediment). They are likely to be found, when albumin is present, in acid urine. They may be found in any of the forms of albuminuria not associated with definite renal disease, etc. Casts and albumin are often absent from the urine for considerable time in chronic interstitial nephritis. It is not safe to base a diagnosis on the non-finding of casts where serious structural renal change is suspected. Temporary albuminuria is frequently associated with athletic exercise. The sphygmograph is often of assistance in distinguishing functional from organic types of albuminuria.

A large amount of albumin without blood or pus may generally indicate chronic tubal nephritis; confirm by high Sp. Gr., microscopic examination of deposit, and appearance of patient. A small amount in a middle-aged or elderly man will probably point to chronic interstitial nephritis. In a young man a mere trace may be only the evidence of a functional albuminuria and the diagnosis must rest on negative evidence to a large extent, a most important factor being relatively high Sp. Gr. unless this has been influenced by nervousness or recent consumption of a large quantity of liquid.—N. Tirard, L. ii./09,1062.

Albuminuria caused by toxic effects of poisonous substances, *e.g.*, lead mercury, phosphorus, cantharides, etc.—B.M.J.E ii./07,81.

**Various forms of albuminuria** classified and described:—(*a*) With renal tube casts. (*b*) With renal tube casts and with pus-(*c*) Without tube casts. Also albuminuria due to (1) febrile conditions, (2) heart failure conditions, (3) so-called 'physiological albuminuria.'—Herbert French, B.M.J. i./11,418.

**Asaprol** (Calcium Beta-naphthol-Sulphonate) precipitates albumin, peptone, &c., from acid solution. On boiling, peptone and albumose redissolve, albumin remains.

**Riegler's Test** ("Beta-naphthalene-Sulphonic Acid") is this—L. ii./08, 1824; B.M.J. i./09,542.

Tablets are made—4 to be dissolved in 5 Cc. of water for use.—Add to 5 Cc. of the specimen filtered if necessary.

**Carbolic Acid** (saturated solution in absolute alcohol) has been used but is not so delicate as Salicyl-sulphonic Acid, but the latter (see below) may be too delicate for clinical work. Further, the milkiness produced by the Phenol emulsifying with the water is a drawback.—L. i,/99,1393.

### Esbach's Picric Acid Solution.

*Mann warns against the voluminous precipitate which one occasionally gets with Esbach's reagent giving a fictitious estimation. He says many albuminous urines give a pale blue with the* **Biuret reaction** *without any tendency to violet; others will give a reddish purple. Such urine indicates by the reddish color some hydrolytic change and will give the incorrect reading referred to.*

Picric Acid 10 Gm., Citric Acid 20 Gm., dissolve in about 900 Cc. boiling water, cool and add water to 1,000 Cc. This reagent is used for the approximate determination of albumin by an Esbach tube which is about six inches long and 0.6 inch in diameter; the graduations on it are the results of experiment and indicate approximately 0.1 up to 0.7% albumin.

By comparison with a standard dried albumin solution, 1 in 1,000 and by heating to 180° F. and centrifugalising, the process can be terminated in a few minutes.

For exact determinations, albumin should be precipitated by some suitable reagent, itself nitrogen-free, *e.g.*, carbolic acid or tannin and the washed precipitate, dried and weighed, or better, the nitrogen contained in it should be estimated by a Kjeldahl analysis, the amount of nitrogen found being multiplied by the factor 6.3 to obtain the amount of proteids.

N.B.—Methlyene blue—in case of patients undergoing treatment with precipitates Esbach's picric acid solution.—L. ii./06,1459.

### Ferrocyanic Acid Test Pellets.

Potassium Ferrocyanide, $K_4Fe(CN)_6+3H_2O=419.66$ (422.358 I.Wts.) and Acetic or Citric Acid mixed in solution set free Hydroferrocyanic Acid. In about a drachm of urine an acid pellet is first dissolved, next a ferrocyanide pellet is added; if albumin is present a precipitate is formed. Does not precipitate peptones. May also be applied as a ring test.

### Heller's Nitric Acid Test.

(See also Roberts' Test *infra* for modifications.)

Nitric Acid is placed in a test tube and the filtered urine, or diluted filtered urine, carefully 'layered' on to it. A white ring at the juncture of the liquids indicates presence of albumin; confirm by another reliable test. Not so delicate as the **heat and Acetic Acid**, but will show 1 in 12,000 at once. Bilious urines may produce play of colours characteristic of Gmelin's test. For *fallacies with the test, vide* below

The test may also be applied by heat—*i.e.* add a little Nitric Acid mix and boil the upper portion.

**Glass Capsules of Nitric Acid** containing one minim are convenient.

Citric Acid 10 Gm. Water 7.5 Cc. may be used as confirmatory test. Apply by layering in similar manner—if mucus present the Citric Acid test will cause turbid ring.—M. 1906,6

In the Cold Nitric Acid Test *white rings more or less like albumen* rings are obtained by—

1 *Albumoses.*—These generally occur in association with albumen; should they occur alone, the ring with Nitric Acid will disappear with warming, to reappear on cooling, and there will be no cloud with the heat test.

2. *Bence-Jones's Albumose.*—This occurs with albumen, gives a ring with nitric acid that disappears on warming, to reappear on cooling; with the heat test a dense cloud appears at about 60° C. to disappear on further heating to boiling point. (*Vide* also p. **149**.)

3. *Nucleo-albumen.*—The ring with this is not in contact with the nitric acid, but higher up and diffuse; it may be a real difficulty in diagnosis from albumen, for it is also precipitated by acetic acid, and may therefore give a cloudiness with the boiling test. The methods of avoiding this fallacy are mentioned under the Acetic Acid and boiling test.

4. *Urates.*—These may form a cloud near the Nitric Acid if the urine is very concentrated; the cloud will disappear on gentle warming, to reappear on cooling, so that it may also be mistaken for albumose: this fallacy may be avoided by diluting the urine with plain water before the nitric acid test is employed.

5. Resins, etc., see next reference.—B.M.J.i./11,417.

Copaiba Balsam, Sandal Oil and Turpentine—treated patients pass urine which cannot be tested for albumin with Nitric Acid as the whole precipitate—albumin and resin dissolve in the alcohol usually added to dissolve the resin. The addition of strong alcohol is however applicable if chromic acid be used as a test—also in case of patients treated with cubebs and coal tar. A false precipitation also occurs in case of patients treated with terpin hydrate.—L.ii./06 1459.

In lobar pneumonia, the urine gives a dense white or dirty white ring or only a haze *above* the junction of the urine and the acid by Heller's test. Sometimes it only appears after the urine has stood an hour or more, whilst in others it appears immediately. If the urine is turbid it must first be filtered. In cases where the reaction appears day after day the prognosis is favourable—if it disappears before the crisis or immediately after, unfavourable symptoms are experienced. The substance is apparently not of the known albumoses. The urine must be fresh.—R. C. Holt.—B.M.J. ii./10,79.

**Meta-Phosphoric Acid**, $HPO_3 = 79{\cdot}44$ ($80{\cdot}048$ I.Wts.).—A fresh solution of a little of this acid is added to the clear filtered urine. A cloud or precipitation indicates presence of albumin.

**Millon's Reagent.—Nitroso-Nitrate of Mercury.** Mercury 10, Nitric Acid (Sp. Gr. 1.185) 25 by weight, Water 25. Dissolve in a flask at lukewarm heat, shaking often, and add to a solution formed by dissolving Mercury 10, in Nitric Acid (Sp. Gr. 1.25 to 1.3) 22 by weight without artificial heat. With albumin or urea this gives a yellow, then red colouration on heating.

**Liquor Bellostii.**—*Syn.* Aqua Capucinica, Mercurous Nitrate Solution.

This consists of a 10% w/w Mercurous Nitrate Solution freshly prepared as follows:—Dissolve crystalline Mercurous Nitrate 1 Gm. in a mortar in a small quantity of Water with 2 drops of Nitric Acid. Make up with Water, added in portions, to 10 by weight.

Can be used to diagnose paralysis by boiling in a test tube a few Cc. of the urine in question then without taking note of any precipitate that may have occurred one adds about 10 to 15 drops of the Reagent and boils again two or three times, taking care that the mixture does not 'bump.' Then allow to deposit. A white precipitate will be produced in all urines. In the case of paralytics, however, it will be gray to grayish-black and the supernatant liquid will be grayish-yellow.—Münch. Med. Woch. No. 1,1911. We have not experience of this test.

**Nitric Acid Test** see **Heller's** above.

**Picric Acid Solution**, see Esbach's solution (*ante*).

The administration of alkaloids may cause urine to give a precipitate with picric acid, but this is redissolved on heating to the boiling point.

**Roberts' Albumin Test.**—Nitric Acid 1 part, Solution of Magnesium Sulphate (10 in 13) 4 parts. Is found to be very satisfactory—advantage, high density. Slope the tube containing a little test solution and allow the urine to slowly run down into it with a dropper.

**A further modified Heller's Test**:—

Ammonium Nitrate may be used instead of Magnesium Sulphate.

After obtaining ring shake slightly—the whole of the urine becomes turbid. This is not the case if ordinary Concentrated Nitric Acid is used, as turbidity dissolves at once.—J.C.S.A. ii/11,347.

**Salicyl-sulphonic Acid.**

$C_6H_3,SO_3H.OH.COOH = 216{\cdot}47$ (218·118 I. Wts.).

In colourless crystals, prepared by action of sulphuric anhydride on salicylic acid. Soluble in water and alcohol. This test requires careful 'layering' of the urine upon a crystal, or a concentrated solution.

Is an extremely precise, reliable, and quick test, giving a dense white precipitate with all proteids.

In confirmation note the following:—

Albumin, globulin, myosin, etc., coagulate on heating.

Albumoses dissolve on heating, and reappear on cooling.

Peptones are not precipitated, except in solutions saturated with ammonium sulphate.

Strongly recommended. Not affected by phosphates, bile, urates or alkaloids.—L. i./99,1085. Also by the late A. H. Allen.—P.J. ii./04,9.

***Endolytic Tubes** (Albumen).—Sealed Capillary tubes partially filled with a solution of this Reagent are portable for clinical use. The ends are snapped off and the urine (if necessary, filtered) is drawn into the tube by capillarity. From opalescence to thick precipitate occurs if positive. Distinguish albumose by pouring hot water over the tube,—precipitate dissolves as above detailed. *Glucose Endolytic Tubes* are also made. (*p.* **171**.)

**Trichloracetic Acid.** *See Vol. I.*, p. 24. A saturated solution is used in the same manner as the last test, or a crystal may be used. May precipitate uric acid and nucleo-proteids.

**Tannin-Hydrochloric Acid Test.**

Mix 5 Cc. of the specimen with 5 Cc. of 1.5% Alcoholic Tannin Solution warm, and add 5 Cc. of Dilute Hydrochloric Acid (1 in 3). Turbidity or yellowish precipitate. Interfering substances such as urates, phosphates and alkaloids are kept in solution by the acid and resins and alkaloids are redissolved by the alcohol and peptones by heating.

## Serum Globulin.

Globulin (held in solution by the salts) coagulates by heat and by Acids—readily soluble in an excess of Acetic Acid. The quantity of Globulin is usually extremely small, but in the advanced stage of many cases of Bright's disease, a marked and persistent increase in the proportion of it is a very unfavourable sign.

**Roberts' Test for Serum Globulin.**

Add the serum drop by drop to a tall cylinder of water. Opalescence is produced, redissolving on addition of a little Acetic Acid or Liquor Potassæ.

*To separate Serum Globulin from Serum Albumin—*

Faintly alkalise and then saturate with Magnesium Sulphate. Globulin is precipitated whilst the Albumin remains in solution. This may be made quantitative by operating on 100 Cc., collecting precipitate, washing with Magnesium Sulphate, dissolving in weak Saline, adding Acetic Acid (few drops) and boiling to coagulate, collecting, drying and weighing.—Mann.

**Globulins.** The proteid of cerebro-spinal fluid is in the main globulin. In general paralysis the proteid is increased, albumin is constantly present. The principal globulin in the fluid in general paralysis is **Euglobulin.** It is the carrier of the interesting antibody operative in the Wassermann reaction (*q.v.*) Euglobulin differs from Serum Globulin in that it is precipitated in a 33% solution of Ammonium Sulphate, whilst 50% is necessary to precipitate Serum globulin.—L. ii/09,210.

When small quantities only are available, as often in lumbar puncture, add a few drops of cerebro-spinal fluid to the following solution freshly made :—(**Spiegler's**) Mercuric Chloride 4, Tartaric Acid 2, Glycerin 10, Distilled Water 100. This gives a cloudy precipitate with only traces of Protein ; specially sensitive to Serum Globulin.

## Albumoses.

**To detect Albumoses.**—Acidulate the specimen with Acetic Acid, add 10% Potassium Ferrocyanide Solution. This precipitates primary Albumoses. This ferrocyanide precipitation distinguishes albumose from *Compound protein.* On warming the precipitate dissolves, to reappear on cooling. This distinguishes from that due to **Serum Albumin.**

Albumoses dissolve on heating (after precipitation by a reagent *e.g.* salicyl-sulphonic acid) and reappear on cooling. What was formerly called '**peptone**' should really apply to albumose. True peptones (as described by Kuhne—true albuminous substances not precipitated by salting with Ammonium Sulphate) do not occur in the urine.

May safely regard all proteids in urine as albumoses, which dissolve, and reappear on cooling, as above mentioned.—L. i./09,682.

**Biuret Reaction.**

After testing for albumin in the usual way with Heller's contact method, this is removed if present by 10% Trichloracetic Acid Solution, and the filtrate then tested with the **Biuret Test.** The author employed this as follows :—

In a test tube place 1 drop of Copper Sulphate Solution (2%), add 5 Cc. urine, then 5 Cc. of Sodium Hydroxide Solution (10%). *A rose pink indicates the presence of albumose.*—L. i./09,682.

**Albumose** (Bence Jones's) occurs in myelopathic albumosuria, a disease associated with morbid conditions of the bones, *vide* B.M.J. ii./06, 1442. This albumose is detected by (1) coagulating at 58° C. *i.e.*, lower than serum albumin, which coagulates at 75° C., (2) precipitates with *hydrochloric* *acid*, (3) nitric acid in the cold—on raising to the boiling point, however, the coagulum dissolves more or less completely and reappears on cooling, (4) with potassium ferrocyanide and citric acid (often takes time to develop, differing in this respect from albumin). The hydrochloric acid test is exceedingly sensitive and does not depend on excess of salts. The result is obtainable after very free dilution of the specimen.

## Bile.

(*With some notes on further abnormal constituents.*)

**Nitric Acid** (B.P. strength is best, W.H.M.) *i.e.*, **Gmelin's Test** produces a bluish-green ring and play of colours.

A moderately icteric urine diluted even 1 in 50 will give this usually.—W.H.M. on application of.—C.D. i./03,171.

**Peptone Test.**—Peptone, in powder 30, Salicylic Acid 4, Acetic Acid 30, Distillled Water 3,500.

Dissolve and filter. Add 1 of urine containing bile salts to 2 of this solution, opalescence (or p.p.) appears; it dissolves completely on adding acetic or citric acid, and diminishes, but does not disappear on boiling.—*Oliver.*

**Sulphanilic Acid.** (*Vide* also *Vol. I.*,p. 284).

1% Solution with Sodium Nitrite 1% and Hydrochloric Acid as a test for bile pigments.—L. i./06,923.

For further details of the test, *c.f.* M. 1906, p. 17.

**Tincture of Iodine.**—A few drops "layered" on to the specimen and the tube shaken gently, produce a green colour if bile pigment be present.

**Pettenköfer's Test** for Bile Salts. Add a few drops of Syrup, shake, and then Sulphuric Acid.—reddish-violet colour, *c.f.* **Acid Cholalic and Sodii Taurocholas in Organic Analysis Chart.**

**Chromic Acid.** 5% solution added gradually produces a green colour.

**Sodium Nitrite** with Sulphuric Acid (Vitali's Reaction) gives green colour.

The spectroscope is employed for detecting **Urochrome, Urobilin, Hæmatoporphyrin, Uroerythrin.**

Urine of patients taking Trional, Tetronal and Sulphonal should be watched for possible hæmatoporphyrinuria.

Hæmatoporphyrinuria does not alone account for the altered color of the urine.—L. i./09,1106.

For these various pigments consult also Mann, 188, *et seq.*

**Urobilin.**

Simple test for (Schlesinger). To the unfiltered urine add alcoholic solution of Zinc Acetate. Shake and add a few drops Lugol's Solution. Fluorescence in varying intensity indicates presence.—B.M.J. ii./08,1357.

**Urobilinogen.** This body is stated to be the parent of Urobilin (*v. above*). Urobilin is formed from it on standing exposed to the atmosphere.

EHRLICH'S TEST FOR UROBILINOGEN (P.G.V.): — Dimethylparaminobenzaldehyde $C_6H_4N(CH_3)_2.COH$ (1:4) M. Pt. 73° C. 2, dissolved in 98 of a mixture of Hydrochloric Acid 4 and Water 1. (*c.f.*, Ehrlich's Indican Test, p. **177**). It will be seen that the parent substances of Indican *viz.* Indol $C_8H_7N$ and Indoxyl $C_8H_5(NH)OH$ bear relation chemically with the bodies contained in Urobilinogen viz., Bilirubin $C_{32}H_{36}N_4O_6$, Hydrobilirubin $C_{32}H_{40}N_4O_7$, etc.

Diagnosis of commoner cases of chronic jaundice. Examination of the urine should be as complete as possible, *e.g.*, test for bile (Gmelin's test is best), for Urobilin (by Alcoholic Zinc Acetate Test), Indican, Sugar ("the presence of this in a case of chronic jaundice is almost pathognomonic of serious disease of the pancreas which may be malignant or inflammatory.") Glycosuria was met with by the author of this paper in 7.5% cases under his care,—(it occurs with almost the same frequency in cancer of the pancreas and in jaundice due to gall-stones,—8% and 9% respectively). Conduct the "pancreatic reaction" (positive reaction obtained in 64% of cases of chronic jaundice), examine for fats, intestinal putrefaction, color etc.—P. J. Cammidge, B.M.J. i./11,486.

**Cholesterin** (*q.v.*) is rarely found. It is usually derived from a collection of pus that has been retained in a cavity for some time, ultimately discharging into the urine. A few recorded cases are detailed.

To separate cholesterin extract the specimen with alcohol-free Ether Purify the residue on evaporation by dissolving in strong alcoholic potash, evaporating, extracting again with Ether, and this again with boiling alcohol—rhombic plates.—Mann.

Chloroformic solution of Cholesterin with Sulphuric Acid gives a red to purple colour. An Alcoholic solution so treated gives red to blue.

Cholesterin crystals in urine, in diabetes with neuritis, in cystitis, in Bright's disease, in pyonephrosis, in epilepsy in a case of hæmaturia with fibrous casts, in tabes and lipuria, in fatty degeneration of the kidneys.—B.M.J. i./03,1008.

**Tyrosin**, $\beta$-Oxyphenylalanin-$\alpha$.
$C_6H_4.OH.C_2H_3(NH_2).COOH = 179{\cdot}77$ (181·098 I.Wts.)

Is recognised by its characteristic crystalline appearance being in shining needles, either in bundles or star form.

Synthesis of, from Potassium Cyanide.—L. ii./06,1583.

*Russula delica.*—The juice of this fungus is a test for Tyrosin; changes it from red to black.

The fungus has stem short 1 to 2 ins. high, ½ in. or more thick, even, smooth, white cap, fleshy, 3 to 5 ins. broad, funnel-shaped when full grown, regular, even, smooth, margin involute, without striæ, flesh firm, dry, white.

Enzymes as Reagents.—Y.B.P. 1907, 55.

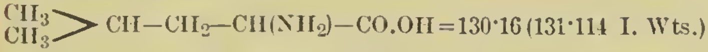
*Further Tests* for Tyrosin.

Two Cc. of Sulphuric Acid mixed with 3 to 5 drops of a Solution of Aldehyde in twice its volume of Alcohol 90%, care being taken that the liquid remains colourless—a few drops added to the suspected liquid produces a gooseberry red colour. This test is supposed to detect Tyrosin up to 1 in 10,000.

Piria states on adding a few drops of strong Sulphuric Acid to a little Tyrosin in a dish it dissolves with slight reddening, on saturating with Barium Carbonate (after diluting) and adding to the filtrate neutral Ferric Chloride Solution a violet colour is formed.—Schmidt.

**Frœhde's Reagent**, *q.v.*, gives blue to violet colour.

**Leucin** $\alpha$-Amido iso-caproic Acid.



$$\left.\begin{matrix}CH_3\\CH_3\end{matrix}\right> CH{-}CH_2{-}CH(NH_2){-}CO.OH = 130{\cdot}16\ (131{\cdot}114\ \text{I. Wts.})$$

**Leucin** occurs as an early result of protein cleavage. There are two isomeric forms of it—respectively lævo- and dextro-.

Is in crystalline spheroidal clumps. An arterial depressor. Is given in arteriosclerosis.—B.M.J. i./06,126.

## Blood Corpuscles

may be recognised microscopically. The red blood corpuscle has an average diameter 7.5 $\mu = \frac{1}{3386}$ inch. It is discoid in shape with indentations in the two sides. Occasionally it is smaller, *e.g.*, 6 $\mu$ ($= \frac{1}{4200}$ inch). Price-Jones determined in normal human blood diameter to be 6 $\mu$ to 8.75 $\mu$—with an average of 7.4 $\mu$, whilst in pernicious anæmia the diameter varied from 4 $\mu$ to 11.75 $\mu$, and the average diameter of five successive 100 cells was 8.0 $\mu$.—B.M.J. ii./10,1418.

In disease it may reach 8 to 10 $\mu = \frac{1}{3175}$ to $\frac{1}{2540}$ inch, *i.e.*, ANISOCYTOSIS, or irregularity in size; further in disease the corpuscles may exhibit POIKILOCYTOSIS, *i.e.*, irregularity in shape. In examination of films VACUOLATION should be noticed, as also irregularity in staining (POLYCHROMATOPHILIA). With regard to abnormal red cells—these are mainly of two kinds, (1) those like normal cells without nuclei, (2) nucleated. The group (1) where they have special designations have names ending in *cyte* (*microcyte*, *megalocyte*, etc., based on the type of the normal corpuscle which is called *erythrocyte*), whilst the nucleated forms have names ending in *blast*. In this group are *normoblasts*, *megaloblasts*. For morphological details and significance we may refer to Emery or other text book. For details of **white** corpuscles *v.* p. **156**.

Blood **Pigments** may be identified microspectroscopically.

**Precipitin Test for Blood** (Uhlenhuth's).—Precipitins are formed when the serum of one kind of animal is introduced into the body of another species, *e.g.*, the serum of a horse injected into a goat causes the serum of the goat to be capable of forming a precipitate with normal horse serum.

In using the test for forensic purposes a rabbit is injected with defibrinated human blood. The serum of the rabbit '**anti-human serum**' when dropped into a clear solution of human blood causes a precipitate,—not in solution of blood from another animal. The principal difficulty in the test is to obtain from the rabbit an antihuman precipitating serum of the proper strength. To be thoroughly reliable and specific *the formation of the precipitate must begin in five minutes and be complete in thirty minutes.* Old blood stains respond as well as recent. It has been stated that the blood of mummies, 3,000-5,000 years old could be identified as human by the method.—L. i./11,319.

Examining mosquitos which had been in contact with certain animals it was possible to determine with accuracy the species of the animal each mosquito had bitten and to prove absence of human blood.—B.M.J. i./10,85.

The test was employed in the Clapham murder case. A human blood stain taken up with normal Saline and some anti-human Serum added causes a white cloudy ring,—not so the stains from animal blood. Specific sera injected into a rabbit from an equally specific anti-serum—in other words, human anti-serum, will infallibly detect human blood,—a horse anti-serum will detect horse's blood and so on.—P.J. i./11,202.

INTERPRETATION OF THE REACTION—An investigation dealing with the weights of the precipitates,—the main mass of the precipitate appears to be composed of anti-substance (Precipitin).—B.M.J. ii./10,1511.

Indian experience with the test was that it is absolutely trustworthy,—the reaction is not effected by the decomposition of the blood, by heat, etc. Fowl's blood used instead of rabbit's. Failures with goat's and monkey's blood.—B.M.J. i./11,1481.

**Hydatid Fluid** may be used to give precipitin test as aid in diagnosis. Interaction between hydatid fluid and serum from hydatid patients has been obtained.

In the rarer cases where the echinococcus has invaded bone structures diagnosis is difficult. The hydatid fluid must be fresh for the test. The presence of eosinophilia is a useful help to diagnosis.—B.M.J. ii./09,957.

Hydatid disease. Complement—fixation as mode of diagnosis. Found to be of considerable value in the few cases available,—positive results are conclusive, negative difficult to interpret. Modified Hecht method used. The alcoholic heart muscle being replaced by Hydatid Fluid of the sheep as antigen. Hitherto the method of diagnosis has been the verification of eosinophilia,—this is, however, characteristic of almost every form of vermiform parasite.—L. ii./10,377.

**Blood in Urine.**—Heller's test consists in heating the specimen with strong potash or soda. If present a colour described as bottle-green is produced, and earthy phosphates coloured brownish-red by blood are precipitated.

Ozonic Ether and Guaiacum Test for,—add a drop or two of *fresh* Tincture of Guaiacum—Guaiacum Resin 1, in Alcohol (90%) *q.s.* to 10- to a small quantity of the urine and shake, 'layer' Ozonic Ether on to the mixture. A blue colour at once, or on standing, indicates presence of blood—Iodine in the urine also gives this colour (*e.g.* if patient has been treated with iodides). Further, pus gives it with Guaiacum Tincture alone, the colour disappearing on heating.

Reactions of Hæmoglobin to the Guaiacum test discussed.—B.M.J. i./06, 75.

**Modified Guaiacum Test using Sodium Perborate.**

To about 5 Cc. of the liquid add 1 to 5 drops of Alcoholic Solution of Guaiacum Resin (saturated in the cold, and not more than 12 hours old), then about 1 Gm. Sodium Perborate and about 10 Cc. of 30% Acetic Acid, shake the mixture once and pour Alcohol carefully into the tube to form a separate layer,—a *blue* or blue-green color at the junction in five minutes will be formed, or green if only a trace. The test is said to show 0.035 Gm. of blood in a litre of water. The Guaiacum resin used must show a *brown*, not a greenish fractured surface.—Chem. Zeit. Aug. 2/10,814, per P.J. ii./10,365.

*Working in our laboratory we found this to indicate* 0.02 *Gm. of blood per litre i.e.,* 1 *in* 50,000. *It is about five times as delicate as the Ozonic Ether Test. A green colour should be disregarded as we found a blank test gives a green. Fresh Solution of Guaiacum had no advantage over seven months old Simple Tincture of Guaiacum.*

**Benzidine**—Saturated Alcoholic Solution—a few drops added—shaken and 'layered' with Ozonic Ether forms blue ring at once. *Vide* also below.

**Blood, Recognition of, in Stains.**—Plunge the cloth into boiling water for a few minutes, place on slide and add few drops of Ammonium Sulphide. Examine microspectroscopically for absorption bands of hæmochromogen. May be increased by 10% Potassium Cyanide Solution. If on a weapon or piece of jewellery, moisten with Ammonium Sulphide and scrape off sufficient and examine as before.—B.M.J. ii./06,1261.

Oxyhæmoglobin in solution with a little Sodium Chloride evaporated over Sulphuric Acid to syrup consistence. Mixed with fifteen times volume of Glacial Acetic Acid and heated on a water bath several hours yields, on cooling, flat rhombic crystals of Hæmatin Hydrochloride with dark violet colour and lustre—this is one of the recognised tests for blood stains.—B.P.C.

Cases of intracorpuscular sulph-hæmoglobanæmia (*enterogenous cyanosis*) probably due to increased formation of sulphuretted hydrogen in the intestine. —L. i./07,275.

**Benzidine.** *Syn. p*-**Diamidodiphenyl.**—$NH_2.C_6H_4.C_6H_4.NH_2$ = 182·80 (184·116 I. Wts.). Grey crystalline powder soluble in alcohol, is used as blood test. Mix the specimen with a little hydrogen peroxide, add a few drops of Acetic Acid and then a little Benzidine Solution—if present blue to green colour. —M./06.55.

We found that a dilution of blood 1 in 200,000 gave a distinct bluish-green color on adding ½ Cc. of 1% Solution of Benzidine in 50% Acetic Acid to 1 Cc. of the dilution.

Commercial Benzidine should be tested before use for the blood reaction. A saturated solution of Benzidine in Alcohol is rendered acid with Acetic Acid, or a saturated solution of Benzidine in Glacial Acetic Acid is mixed with an equal quantity of Hydrogen Peroxide, and a few Cc. of Water added. No coloration or only a slight one should occur in a few minutes.—M. 1910, 141, per P.J ii./10,492.

Diastases, Zymases, Fruit Juices give similar reaction. A positive reaction does not prove blood, but the negative proves its absence.—P.J. ii./10,298.

Tablets may be made of Benzidine 0.1 Gm. and Sodium Perborate 0.1 Gm. (better than $H_2O_2$). Just before use dissolve a Tablet in 10 Cc. Glacial Acetic Acid. If a suspected spot on an article of clothing, etc, is to be examined it is moistened with a drop of Normal Saline and well rubbed with a glass rod. The drop is then absorbed in a small piece of absorbent cotton wool and the spot at once treated with a few drops of the Reagent. In presence of blood a blue color is seen.—J.C.S.A. ii./10,665.

FÆCES, TESTS FOR OCCULT BLOOD IN,—(1). Modified Benzidine, (2). Aloin Test, (3). Guaiacum Test,—P. J. Cammidge.—B.M.J. ii./10,409. *See* also **Fæces.**—*p.* **168**.

**Choline.—Halliburton and Rosenheim's Test for in the Blood and Cerebro-spinal Fluid.**—Dark brown crystals (Choline Periodide) resembling hæmin appear on adding a strong solution of Iodine in Potassium Iodide to Choline-platino-chloride crystals. To prepare the Platino Chloride of Choline is, however, not essential, as the test can be applied direct to the Alcoholic Extract of the fluid.

Acetyl-Choline (artificial) has a powerful depressing action on blood pressure, being capable of overcoming the effects of Adrenalin.—V. *also Vol. I.*, p. 496.

Chemistry of the blood,—some notes on—Na. Aug. 1911, p. 204.

**Blood, Estimation of Hæmoglobin.**—Sir Wm. R. Gowers' apparatus consists of two tubes, flattened or round, one closed, containing glycerin jelly coloured with picro-carmin—the standard equal to the colour of a dilution of average normal blood one hundred times (20 cmm. in 2 Cc.), and the other, graduated in 100 degrees = 2 Cc., for the dilution of the sample of blood with distilled water. The outfit further includes a pipette, pricker, india rubber stand, &c.

The lobe of the ear or the finger is pricked and 20 cmm. of blood are drawn up into the pipette, injected into the graduated tube, which should at the time contain a few drops of water to prevent possible coagulation and facilitate mixture. Water is then added sufficient to produce a tint the same as the standard, the two being frequently compared during the process. The degrees of dilution needed indicate the percentage amount of hæmoglobin. For example, 20 cmm. of blood from an anæmic patient giving the standard tint at 30 degrees of dilution would contain only 30% of the normal quantity of hæmoglobin.

**Haldane's Modification** of Sir W. Gowers' Hæmoglobinometer is now extensively used where coal gas is available. The standard tint tube is a $1^0/_0$ solution of blood containing the average percentage of hæmoglobin found in the blood of healthy adult men, and having an oxygen capacity of $18{\cdot}5^0/_0$ as determined by the ferricyanide method. *The solution is saturated with carbon monoxide*, and hermetically scaled. It is both definite and permanent. The graduated tube holds 2 Cc. when filled so that the inside is completely wetted and the liquid stands at the mark 100 after half a minute has been allowed for the upper part to drain. The tube is graduated in percentages of 2 Cc.

A cap for attachment to a gas-burner serves to deliver gas for saturating the diluted blood with CO.

The advantages of the modifications are: (1) that the standard solution is a definite one, so that an instrument can be verified at any time by making a determination with ox-blood of which the oxygen capacity has been determined by the ferricyanide method; (2) that the standard solution is permanent; (3) that the apparatus can be used with equal correctness by daylight and artificial light.

As coal-gas is not always available in examining the blood of patients the instrument can always be supplied with an additional standard tube containing picro-carmine jelly, as in the original Gowers' Hæmoglobinometer. The picro-carmine jelly is standardised to correspond with blood of $18{\cdot}5^0/_0$ oxygen capacity, but is liable to slow alteration on keeping. Its value in terms of the sealed tube of blood-solution should therefore be occasionally ascertained by determining the hæmoglobin in blood from the same person, first by the picro-carmine standard and afterwards by the sealed blood standard. The difference gives the percentage correction needed for the picro-carmine standard. The picro-carmine standard tube should be kept in the box, and not exposed unnecessarily to light.

Other Hæmoglobinometers are those of Oliver, Fleischl and Sahli.

Sahli's is unreliable owing to acid haematin, the standard employed, not being stable, the substance deposits in time. The Gowers-Haldane Instrument *vide* above, is the best.—B.M.J. i/11,1474.

**Hæmoglobin Scale** according to **Tallquist** consists of a scale with strip of blotting paper to suck up the blood for examination. The tint thus produced is compared by direct light with the scale. The scale indicates 10, 20, 30, &c. up to 100. This refers to amount of hæmoglobin—100 being taken as normal.

**Rotary Hæmoglobinometer.** A. J. Hall has devised an instrument on similar lines. For directions for use, *vide* L. i./09,696.

**Blood, Number of Corpuscles.**—One cubic millimeter contains normally about 5,000,000 to 6,000,000 red corpuscles in man, and about 4,500,000 in woman. The average number of white corpuscles per cubic millimeter is about 7,000 to 8,000 in adults, and 10,000 in children.

The hæmacytometers chiefly employed are Gowers' modification of Hayem's, and that of Thoma-Zeiss.

In the **Gowers Instrument** the cell is $\frac{1}{5}$ mm. deep, and each side of a square is $\frac{1}{10}$ mm., hence the volume of the small square is $\frac{1}{500}$ cmm. This instrument contains, in addition to the cell, a small pipette which, when filled to the mark on its stem, holds exactly ·995 cmm., a capillary tube marked to contain exactly 5 cmm., a glass stirrer, a lancet needle, &c. The dilution employed is 1 to 200. The number of corpuscles in 10 squares is counted, and this multiplied by 10,000 gives the number in a cubic millimeter. The above dilution and squares are so arranged that normal blood presents 50 corpuscles per square, or 100 in 2 squares; and by counting 10 squares so as to get the average for two, the *percentage* of corpuscles to that of health is evident, and may be compared with the percentage of hæmoglobin as ascertained by Sir Wm. R. Gowers' hæmoglobinometer, *v.*p. **154**.

If, for instance, the blood contain 80% of corpuscles and only 40% hæmoglobin, the value of each corpuscle is represented by the fraction $\frac{1}{2}$. Sometimes in pernicious anæmia the corpuscles sink below the amount of hæmoglobin, and there may be 30% of corpuscles and 40% of hæmoglobin, in which case the value of the corpuscle is $\frac{4}{3}$. The corpuscles having settled, and the percentage ascertained, the objective may be raised so that the corpuscles are somewhat out of focus, the **leucocytes** then appear as bright points, in consequence of their greater refraction, and their number may be counted. Sir Wm. R. Gowers prefers this method to that of staining, *v.* p. **156**.

The **Thoma-Zeiss** instrument consists of micrometer slide divided into 16 squares, each square again divided into 16 smaller squares. It has two pipettes, one for diluting the blood 1 to 100 and 1 to 200 for counting the red corpuscles, the other is intended for estimation of the leucocytes, and dilutes the blood 10 or 20 times. The number of red corpuscles seen in 4, 6, or if greater accuracy is required, 16 (larger) squares, *i.e.*, in 64, 96 or 256 smaller squares, is counted. To ascertain the **number of Red Corpuscles** in 1 cmm. of blood, knowing the volume of the cube standing on each small square to be $\frac{1}{4000}$ cmm., *multiply the total number of red corpuscles counted by* 4,000 *times the number of times of dilution of the blood and divide the result by the number of small squares in which red corpuscles have been counted.* It is always desirable to have an assistant to note the numbers observed, and to count the corpuscles touching and overlapping the two adjacent boundary lines on the left upper corners of the squares, but those on or overlapping the other two sides are excluded to compensate.

The normal dilution is 1 to 200; in polyemia 1 to 400; and in excessive anæmia 1 to 100 may be used. 5 or 6 corpuscles per square are a convenient number for counting.

The Thoma-Zeiss cell is $\frac{1}{10}$ mm. deep, and each side of a small square is $\frac{1}{20}$ mm., hence the above figure $\frac{1}{4000}$ cmm. as the volume of a small square.

The fluid used for diluting in both the above instruments is **Sir Wm. R. Gowers' Hæmacytometer Solution**:—Sodium Sulphate 104 grains, Acetic Acid 1 drachm, Distilled Water 4 ounces. Filter.

**Hayem's Solution** is also employed. Sodium Chloride 2, Sodium Sulphate 5, Mercuric Perchloride 0·5, Water 200.

*Correction of Error with formulæ.*—B.M.J.E. i./08,12.

**Edington's Hæmacytometer Solution.**—Sodium Citrate (neutral) 7.5 Gm. Formalin (40% Commercial), 2.0 Cc. Dahlia (Methyl Violet), 0.03 Gm. Chloroform 5 drops. Distilled Water 250 Cc. Mix the stain with the water, then add the Sodium Citrate and the Formalin. Has the advantage that in less than 1 minute, all the corpuscles are deposited on the slide and in focus The refractive index of the corpuscles is well maintained.—L. ii./07.86.

The **Ehrlich Blenden Eyepiece** is stated to simplify counting either red or white corpuscles. It consists of an ordinary No. 2 eyepiece with a screen which cuts out a square from the field of vision. The number of corpuscles seen per square (average of several counts) × 4000 × the dilution (1 in 100 or 1 in 200) gives the number per cubic mm.—L. ii./09.1424.

**Estimation of Red Corpuscles** by means of the **Hæmatocrite** (not satisfactory for the white). This instrument consists of two graduated capillary tubes in a metal frame for inserting in a centrifuge to be revolved at high speed. The finger is pricked after cleansing with carbolic solution; the first drop of blood is rejected—this is important—and the next exuding is taken up into both tubes by capillarity; it is then centrifugalised for one minute with 10,000 revolutions. The red corpuscles having the higher sp. gr. are separated at the distal extremity of the tube. Normal blood should reach the mark 45 to 50, indicating 4,500,000 to 5,000,000 corpuscles per cubic m.m. Taking the 5,000,000 as a standard, if the corpuscles reach the mark 25 this indicates a percentage by volume 50 or 2,500,000 red corpuscles per cubic mm.

The '**Color Index**' is the index of corpuscular richness. It is obtained by dividing the percentage of Hæmoglobin by the percentage of Red Corpuscles With the normal of Red Corpuscles as 5,000,000 and the Hæmoglobin at 100 the index is $\frac{100}{100} = 1$. In a case of Red Corpuscles 4,000,000 (=80% of normal) and Hæmoglobin 40%, the index would be $\frac{40}{80} = 0.5$. Consult Emery, p. 192 for importance of this index in differentiating chlorosis, pernicious anæmia and in other types of anæmia.

**The Number of Leucocytes** may be estimated in a similar manner, by the **Thoma-Zeiss** instrument, but in this case it is desirable to stain them before counting by using Gowers' diluting fluid, with an appreciable addition of Löffler's Methylene Blue, or by **Toison's Solution** (Dissolve Methyl Violet 5 B. 0.025 Gm. in a mixture of Glycerin 30 Cc. and Water 80 Cc. Dissolve separately Sodium Sulphate 8 Gm. with Sodium Chloride 1 Gm. in Water 80 Cc. Mix and filter). Leucocytes stained violet, red corpuscles greenish. For accuracy count as many squares as possible.

A further formula for the staining fluid is Formalin 1.5, Sodium Chloride 0.5, Sodium Sulphate 2.5, Methyl Violet 0.01, Water 100.

Another method is to use an aqueous $\frac{1}{3}$% acetic acid solution as diluent, in this the red corpuscles become invisible while the leucocytes remain visible (Thoma-Zeiss).

In **Leucocytosis** the number of white corpuscles may be increased from the normal 7,000 or 8,000 up to 12,000, or even to as many as 1,000,000 per cubic mm.—L. i./03,361.

## Leucocytes in Normal Blood.

(Regular Nuclei). (1). Lymphocytes, small, } 25% (L.).
,, ,, large }
(In childhood more numerous,—up to 60%.).
(2). Hyaline (large Mononuclear Cells) 1 to 2% (H.).
(3). Transitional Cells 1 to 2% (T.).
(Irregular Nuclei.) (4). Polymorphonuclear neutrophiles 70 to 80% (P.).
(In childhood only 30 to 40%).
(5). Oxyphile cells (Eosinophile Leucocyte-) 3 to 5% (E)
(6). Basophile Cells (Mast Cells) 0.5% (B.).
(Often not found in persons in robust health.)

The cells comprised in Nos. 1 to 3 are sometimes called the non-granular whilst those in 4 to 6 are called the granular leucocytes, *i.e.*, they contain granules in their protoplasm. The initial letters are commonly used for counting purposes. For an account of Recent Advances in Hæmatology see W. K. Hunter (The Dr. James Watson Lectures) Glasg. Med. Jl. vol. LXXIV. *et seq.*

Consult also Green's Encyclopedia, Emery, etc. For the method of differential counting of the Leucocytes and signification of data in disease, Emery's work may well be used.

**Strong and Seligman's Method.** The stain is composed of Methyl Violet 0.012 Gm., Sodium Chloride 0.75 Gm., Formalin Solution 1.5 Cc. Distilled Water 100.0 Cc.

A new method of blood-counting producing permanent preparations which may be used subsequently. Eliminates ruled counting chamber and error due to variations in the depths of the cells.—B.M.J. ii./03,74.

Enumeration of leucocytes after staining by Leishman's stain (*v. infra*).—Leishman. B.M.J. i./06,680.

**Leucocytes, Improved Method of Counting.** To stain a 3% sodium chloride solution deeply coloured with Gentian Violet is sufficient. It is simpler to count whole microscopic fields of known area rather than squares. Employing the 1 in 20 pipette, count whole microscopic field, not the squares, move the draw-tube of microscope into such position that 7½ squares in diameter (Thoma-Zeiss scale) are in view. The cubic contents of this = $\frac{1}{100}$ Cmm. Make a mark on the draw-tube—to be used for all occasions. Count twenty fields with above dilution, and add two cyphers to the number so obtained.—B.M.J. i./05,410,576,696,914,1132.

### Leucocytes.—A simple method of counting.

Draw up measured quantity of blood with capillary tube and pipette, and in the same manner ten times as much water, mix on watch glass. Drops (all the same size of the mixture are arranged on a slide (*s.a.*) in line. Dry slowly in the sun or before a fire, then gently agitate in a dish of water until all pigment is washed off. Examined under the microscope each spot will be seen to consist of a faint amount of debris with dark conspicuous leucocytes. They may be stained with Methylene Blue if preferred. Count the cells in several fields, using ⅙ in. objective, a stiff paper obturator (pierced with ranks of 20 or more holes made by a large needle—each, on an average with normal blood, to show 2 or 3 leucocytes per hole) is fitted in the eyepiece. If 10 films be searched thus, a good average will be obtained. Two to four fields, each from a different film, is sufficient to count as a rule. The average number per field for normal persons is noted—*i.e.*, 8,000 per cmm. A simple comparison indicates degree of leucocytosis.—B.M.J. ii./09,1749.

A simple method of obtaining a preparation of living, isolated leucocytes. —L. ii /08,1746.

H. C. Ross has devised a method of determining whether leucocytes are living or dead by examining the blood on an agar film containing atropine and a stain.—L. i. 09,389. B.M.J. ii./09,514.

**Total and Differential Leucocyte Count conducted simultaneously.**

***Diluent employed*** is a mixture of Wright's Modification of Leishman's Stain 4, Acetone 3, Methyl Alcohol 1, Water 12. This is used freshly made up and filtered in any dilution from 1 in 200 to 1 in 10. The white cells stain as in a film, whilst the red are colourless. A dilution 1 in 100 gives about 80 cells on the large square of a Thoma-Zappert Slide which is enough for the total count, whilst 300 elsewhere can be found for the differential. In marked leucopenia, a 1 in 10 dilution gives as many cells as required in a few minutes. In many cases a glance gives the result, *e.g.* a marked eosinophilia, or excess of lymphocytes, large mononuclears or polymorphic cells. The stain is mixed with the blood in a small tube, *e.g.* a Haldane Haemoglobinometer tube cut down to the 120 mark. With this, 24 divisions of water and the rest in proportion are sufficient for a 1 in 100 pipette if it can reach to the bottom.—L. i./12,29.

*Note.—All tinting solutions should be freshly prepared as precipitates interfere with accurate counting.*

**Leucocytic Extract** in infective processes. It was found that the injection of living leucocytes or their extracts produced remarkable effects upon artificial microbic infections in animals, both for prevention and cure. Latterly the extract has been employed in man. The method of obtaining the extract is to inject sterile 10% suspension of Mellin's Food in Distilled Water in amounts of 5 to 10 Cc., according to size of the rabbit used, into each pleural cavity. The animal is killed 24 hours afterwards and the fluid exudate is removed. Special directions are given to ensure the exudate being removed in a sterile condition.—10 to 20 Cc. is the average amount obtained. The leucocytes are centrifugalised and suspended in an equal volume of distilled water. Finally the ' Extract ' is put up in 10 Cc. ampoules and will keep three months. Records of 10 cases treated are provided. The extract seems to act as a marked leucocytic stimulant, *e.g.*, a blood count before injection showed 6,800 leucocytes, 12 hours after injection of 8 Cc.,—the count was 50,000 Again another count gave 5,280 before injection of 3 Cc. After 19 hours the count was 17,000 and so on.—B.M.J. i./11,355.

**A Blood count in a case of medullary leukæmia** showing improvement under Arsenic and Iron.

| | | | | |
|---|---|---|---|---|
| Red Corpuscles | 3,600,000 | after | 9 days | 4,840,000 |
| Hæmoglobin % | 30 | ,, | ,, | 45 |
| Color Index | 0.4 | ,, | ,, | 0.8 |
| Total White Cells | 77.700 | ,, | ,, | 42,000 |
| Polymorph. Neutrophiles | 50.7 | ,, | ,, | 46 |
| Large Lymphocytes | 11.2 | ,, | ,, | 12.5 |
| Small Lymphocytes | 2.3 | ,, | ,, | 1.5 |
| Hyaline Lymphocytes | 0.5 | ,, | ,, | 0.5 |
| Transitional | 0.7 | ,, | ,, | 9.5 |
| Basophiles | 5.5 | ,, | ,, | — |
| Eosinophiles | 0.3 | ,, | ,, | 4.0 |
| Myelocytes:— | | | | |
| Neutrophile | 17.0 | ,, | ,, | — |
| Basophile | 11.0 | ,, | ,, | 26.0 |
| Eosinophile | 0.6 | ,, | ,, | — |
| Mixed | 0.2 | ,, | ,, | — |

Many nucleated cells, poikylocytosis, anisocytosis, vacuolation.—A. E. Barker, P.R.S.M., Clin. Sectn. March 1910, p. 121.

MYELOGENOUS LEUKÆMIA in an infant of 18 months:—

Red Corpuscles 4,080,000 per Cmm., White Corpuscles 63,400, Hæmoglobin 80%, Polymorphonuclears 32.4%, Lymphocytes 5.2%, Large Mononuclears 18.8%, Transitional 12.8%, Eosinophiles 2.8%, Basophiles 0.6%, Myelocytes —Neutrophile 25.8% and Eosinophile 1.6%, Normoblasts 1.6 per 100 leucocytes. The proportion of myelocytes is not so great as is found in cases of this disease in adults. The number of large mononuclears is excessive. It is possible these large mononuclear cells are the precursors of myelocytes, *i.e.*, myelocytes before they have taken on a fine granulation. Myelogenous leukæmia at such an early age is distinctly rare.—P.R.S.M. Diseases of Children, Sect., March 1910, p. 92.

For details of average (adult) spleno-medullary leucocythæmia blood count see Emery, p. 219.

A rapidly fatal case.—B.M.J. i./11,198.

'X' bodies in the blood in a patient suffering from a recurrent or intermittent urticaria in the Sudan.—L. i./11,295.

**On the Value of Blood Examination to the General Practitioner.** Value of Blood Examination in treatment of chlorosis. Fallacy of giving more iron in one week than the body contains under ordinary circumstances. Chlorosis will improve and recover without any iron at all. In chlorosis the total amount of hæmoglobin is normal even though the readings by the hæmoglobinometer may give figures below normal. A given unit of blood removed from a patient suffering from chlorosis contains less hæmoglobin than the same volume in health—this is due to the fact that in chlorosis the blood plasma is increased in quantity, and there is therefore less room in the particular volume of chlorotic blood for the number of corpuscles usually existant. Though the number of red corpuscles may by a count show as low as 3,222,000, the absolute number of same is really much greater even by as much as three times or more. Therefore, as the total amount of hæmoglobin is normal in chlorosis, each red corpuscle will contain less hæmoglobin than normally.—The investigations of Lorrain Smith.—Batty Shaw; B.M.J. i./07,973.

Blood examinations in 30 cases of rickets showed that only nine presented anæmia, in not one of which was the number of red cells less than 4,100,000 per c.m.m. In 19 there was a slight increase in the number of white cells.—B.M.J. i./09,1177.

**Volume of Blood.**—Method of estimating. The principle employed was to inject into the blood stream a known amount of hæmoglobin, and then determine degree of resulting hæmoglobinæmia.—B.M.J. i./09,1357.

In PERNICIOUS ANÆMIA the red corpuscles, instead of 5,000,000 or more per c.m.m. are only 2,000,000 or even as low as 1,000,000. Hæmoglobin is also reduced, but not to an equal extent. *A very useful account of the microscopy of the blood in this condition.*—B.M.J. i. 09 1348 .v

## Blood Staining.

To make films, prick patient's finger, press, let first drop of blood fall away, place the next drop (small) on the centre of a *really clean* $\frac{7}{8}$ in. square cover slip. Superpose another and pull off so that the film is thin and even—not 'ridges' and 'valleys' and dry in the air. No fixing is necessary,—the Methyl Alcohol in the stain (Leishman, etc.) does this.

**Jenner's Stain** is used. It may be prepared by mixing freshly 100 Cc. 0.5% Solution of Medicinal Methylene Blue in Absolute Methylic Alcohol with 125 Cc. of a 0.5 Solution of Eosin (water soluble yellow shade). Filter. A similar stain is produced by dissolving the precipitation compound—(Eosin Blue) in Methyl Alcohol.—*c.f.* Leishman's Stain.

*Method of use.*—Add $\frac{1}{5}$ volume of Distilled Water to the Stain when on the film (*e.g.* 1 drop to 5 drops), rock gently. Stain for five minutes, then wash in distilled water until pink tint replaces greenish colour. Remove excess of water by filter paper and dry in the air without heating.

Should be kept in stoppered bottles well closed, and is best recently prepared. The Methylene Blue and Eosin are said to combine, forming a chemical compound. In staining it is important to cover with a watch glass to prevent evaporation of the Methyl Alcohol.—L. i./99, 370.

**Jenner's Stain** is, *we found, improved by using Polychrome Methylene Blue* in place of ordinary Methylene Blue. The 'polychromatising' we effected by adding finely powdered crystalline Sodium Carbonate to the Methylene Blue Solution in the proportion of 1 Gm. of Sodium Carbonate to each 2 Gm. of Methylene Blue. This gave a stain in which blue elements overstained by using Jenner's directions, but by using Wright's method (covering film with a few drops of the Stain, allowing to stand 10 seconds, and diluting with two volumes of water) the resulting film was good.

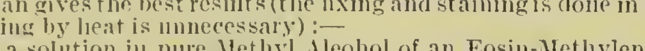
We also found that the proportion of the Eosin Solution may be increased, *e.g.*, Eosin Solution 2 and (*Polychrome*) Methylene Blue Solution 1, gave good result.

**Romanowsky's Stain, Leishman's Modification.**—There are various modes of making and supplying this stain. The following as suggested by Leishman gives the best results (the fixing and staining is done in one process so that fixing by heat is unnecessary) :—

This is a solution in pure Methyl Alcohol of an Eosin-Methylene-Blue-precipitation-compound, 0.15 grammes of the compound being dissolved in 100 Cc. of Methyl Alcohol. The solution thus formed is a clear dark blue liquid, showing a green iridescence by reflected light. The Stain is used by preparing films of blood in the usual way on clean cover glasses, and allowing to dry in the air. The films should be as thin as possible. Three or four drops of the Stain are dropped on to the film and the cover glass is rotated, no attempt being made to check evaporation as in the case of Jenner's Stain. After about half a minute six or eight drops of water are added, and allowed to mix by rotating with the Stain, and staining is allowed to proceed for five minutes; in certain cases ten minutes may be necessary. The film is now washed with distilled water, and a few drops of the water are allowed to remain on it for one minute. It is finally dried without heating and examined with an oil immersion lens.

(Note, the strength of the Stain may in some cases have to be increased somewhat, the volume of water added in staining may require modifying,—*e.g.*, to the same volume as that of the stain or less.)

Note.—Leishman in his original paper (B.M.J. ii./01,757) directs Methylene Blue to Eosin in proportion 10 to 1 to make the precipitation compound. Reckoning water-soluble Eosin as of formula



$$C_6H_4 \left< \begin{matrix} CO.\ C_6HBr_2ONa \\ CO.\ C_6HBr_2ONa \end{matrix} \right> 0.6H_2O \ (= 800 \text{ approx.})$$

it may be pointed out that this does not appear to have any relationship with Methylene Blue which has composition $C_{12}H_6N_3S(CH_3)_4Cl = 320$ approx.

1. Mol. Eosin of above formula should be equivalent 2 Mols. Methylene Blue = 2 × 320 = 640. In some experiments which we conducted using ordinary Commercial Methylene Blue cryst. 6.4 Gm. $\left(= \frac{2 \text{ Mol. Wts.}}{\ }\right)$ and Eosin (water soluble, yellow shade) 8.0 Gm. $\left(= \frac{1 \text{ Mol. Wt.}}{100}\right)$ in 1% solutions each; mixing as directed, adding 2,8 Gm. $\left(= \frac{1 \text{ Mol. Wt.}}{100}\right)$ of Sodium Carbonate cryst. and boiling half an hour, collecting the precipitate and washing until runnings were of pale blue color, we obtained *a better yield* than by Leishman's Method,

The precipitate, as above dissolved in the requisite proportion (0.15%) in Methylic Alcohol stained blood films satisfactorily. But even on these lines no chemical formula can be devised to show the reaction. The Stain appears to be based on experimental finding.

The following results are obtained :—

RED BLOOD CORPUSCLES are stained pink or greenish.

POLYMORPHONUCLEAR LEUCOCYTES red. Nuclear network blue. Extra-nuclear protoplasm colourless. Fine eosinophile granules red.

MONONUCLEARS or HYALINE or LARGE LYMPHOCYTES.—Nuclei pale blue. Extra-nuclear protoplasm blue, occasionally showing red granules.

TRANSITIONAL.—As with large mononuclears, except nucleus is reniform.

SMALL LYMPHOCYTES as mononuclears, except nuclei deeper stained.

COARSELY GRANULAR EOSINOPHILES.—Nucleus blue but not so deep. Granules pink.

BASOPHILES.—Granules deep-stained purple black. Nucleus red but usually somewhat masked by granules over-laying it.

NUCLEATED RED CELLS.—Nucleus almost black with sharp outline. Extra-nuclear portion grey.

MYELOCYTES stain pale red nuclei pale blue.

BLOOD PLATES deep red with spiky margins, often with pale blue peripheral zone.

BACILLI and MICROCOCCI blue.

MALARIAL PARASITES.—Body stains blue and its chromatin deep red.—B.M.J i./01,635 ; ii./01,757 (with some slight revisions by Wyatt Wingrave embodied) *Vide* also Malarial Parasites, *Vol. I.*, p. 889, *Vol. II.*, p. **218**.

Wyatt Wingrave finds that the addition of Glycerin (a small proportion) ntensifies the Leishman and allied Stains and shortens exposure.

**Leishman's Stain (Wright's Modification).**—Add Methylene Blue 1 Gm. to 100 Cc. of 0.5% Sodium Bicarbonate Solution. Sterilise in a flask in a steam steriliser for one hour. Place in a large dish and add while sterilising, 1 in 1,000 Eosin Solution (yellowish, soluble in water) until the mixture changes to purple and shows yellowish scum on the surface. About 500 Cc. of the Eosin Solution will be required. Collect precipitate formed, and dry in an incubator without washing. When thoroughly dry dissolve 0.3 Gm. of the powder in 100 Cc. pure Methylic Alcohol. Filter this saturated solution and add to the filtrate further 25% of Methyl Alcohol, *i.e.*, to 80 Cc. add 20 Cc. It is now ready for use.

Method of use.—Pour stain on to film and stain one minute. Add water drop by drop until greenish scum forms on surface (for ⅞ inch cover glass 6 to 8 drops required), stain with this further two minutes, wash in distilled water, and soak in same 2 minutes or more, until the thinner parts of film appear yellowish pink, dry with filter paper (no heat) and mount in Xylol Balsam.

Normal Erythrocytes appear yellow or pink. In cells deficient in hæmoglobin the colour is from a pale pink with large central clear space to dirty yellow. Polychromatophilic cells bluish. Granular degeneration or basophilic degeneration shows well as small bluish dots in a pink cytoplasm. Normo-blasts have a pink cytoplasm and blue nucleus (in some the cytoplasm is yellowish, purplish, or bluish). Megaloblasts show blue nucleus and yellowish or bluish cytoplasm.—M.A. 1906,139.

The various solutions of Eosinote of Blue lose their differential staining power particularly with regard to the granules, after keeping a few weeks (especially in hot weather). Jenner's and Leishman's Stains may be "reactivated" by adding a very small quantity of the original powder.—Wyatt Wingrave.

**Modified Leishman Stain, using Dibromo-dinitro-fluorescein in place of ordinary Eosin.**

Note.—Dibromo-dinitro Fluorescein has *Syn.* **Eosin B. N.**, **Methyl Eosin** (wrongly so-called) and **Eosin Scarlet B.**

By Romanowsky Staining is meant the production of blue in basophile cytoplasm and violet to magenta in nuclei and some other structures by the stain. Leishman's method though good for parasites is said to give feeble staining of the eosinophile and neutrophile leucocyte granules. The following is said to produce uniform results as regards the blood cells. Add to a filtered solution of Methylene Blue (the strength is immaterial), with stirring, a similar solution of the 'Methyl Eosin' until the mother liquor is only faintly blue,—then add cautiously—often at this stage a weaker solution is desirable—to exactly neutralise. The end reaction is seen by running a drop of the liquid down a sloping glass plate behind which is some white paper—collect precipitate on tough filter paper without pressure, wash with water and dry at not exceeding 50° C. Prepare the stain by dissolving 0.15% of the precipitation compound in pure Methyl Alcohol.

(a) To produce pure blue and pink staining, as distinct from Romanowsky's effect, add 6 drops of the stain to an air dried film. Pour off into 1 Cc. of water in test tube, mix, pour back on to slide spreading with mouth of the inverted test tube. Leave 10 minutes, then wash for a few seconds with distilled water, blot to dry.

(*b*). To produce Romanowsky's staining. If violet nuclei are preferred, use three drops of the Eosin Scarlet Methylene Blue Stain and three of **Eosin Toluidine- Blue** (made similarly but of 0.1% strength).

For staining deeper use 4 drops Eosin-Scarlet Methylene Blue, and 3 drops Eosin-Thionin (0.04%).—Jl. Path. and Bact., July 1911, p. 148.

NOTE.—We have prepared the Eosin Scarlet Methylene Blue using a 1% solution of the Blue, and a 1% solution of the Eosin Scarlet. We found that 110 Cc. of the latter to 100 Cc. of the former was about the correct proportion.

It is not practicable to produce a solution stronger than 0.15% of the precipitation compound in Methyl Alcohol.

An independent report with this stain says—results excellent, quick and reliable,—good for differential counting. Was best employed as follows:—' Flood film for at least three minutes with the stain; dilute with its own volume of distilled water, rock five minutes and wash five times with distilled water

A method of studying action of blood fluids and other substances on leucocytes.—P.R.S.M. Path. Sect., Jan. 1910, 73.

Method of **distinguishing dead and living leucocytes** by means of Neutral Red. Mix 10 drops of a solution of Sodium Chloride 0.9% containing 0.6% Sodium Citrate with 10 drops of a solution of Sodium Chloride 0.9% containing Neutral Red 0.1%. Add 1 drop of blood or 1 to 4 drops of the sediment of a centrifugalised exudate containing leucocytes. Place in the incubator and maintain at 37° C. for twenty minutes, then count the leucocytes (living stained red and the dead ones not coloured). In circulating blood there are no dead leucocytes even in the most grave diseases. In abscesses the number of dead leucocytes suddenly decreases after an incision. In acute meningitis it appears the variations in the dead leucocytes is valuable for diagnosis; their disappearance is a good sign; increase an unfavourable one:—a few stained nuclei are found in old suppurations, for instance in tuberculous empyema amongst a great deal of leucocytic remains.—B.M.J ii./10,1416.

Influence of under feeding on the blood.—Jl. Path. Bact., Oct. 1911.

**Hæmoconia.**—In the intercorpuscular spaces in fresh blood films, made with aseptic precautions, moving bodies are observed of varying shapes ranging in size from a small micrococcus to a small microcyte. F. Porter has classified these into 5 groups and describes changes which take place in such a film during 6 days. See also De Korté and F. C. Eve.—B.M.J. ii./07,1399.

The phenomenon, which is irrespective of gravity, may be explained by the assumption that the salts in the dried blood cause differences in electrical potential between the different layers of the Agar.—J. S. MacDonald, B.M.J. i./06,1194.

### Calcium Salts in Blood, Estimation of by Blair Bell's Calcimeter, *v.p* 26.

### Examination of Blood and Urine by determination of the freezing point.

Lately methods of examination have been introduced to show the excretory power of the kidneys. One important method is the determination of the molecular concentration of the specimen, by a process of "Cryoscopy." The excretory action of the kidney causes different degrees of concentration of the fluid flowing into the kidney as compared with the fluid flowing out of it. Molecular concentration influences osmotic pressure, and is independent of the nature of the substance dissolved in the fluids; it is determined more particularly by the number of molecules dissolved in unit volume; the osmotic pressure of a liquid is proportional to its molecular concentration. We have a very easy way of measuring indirectly the changes in the molecular concentration, and, therefore, in the osmotic pressure of a solution by determining the freezing point of the liquid in question. The freezing point of a solution is so much below that of distilled water as its molecular concentration is greater, and *vice versa*. Solutions with the same freezing point have the same molecular concentration, and therefore, the same osmotic pressure.

The apparatus used is the well-known Beckmann's Apparatus, consisting of a thermometer, divided into hundredths of a degree, which is situated in a tube, and in the same test tube there is arranged a stirrer made of platinum wire. The tube is then filled with about 20 to 50 Cc. of the solution to be examined, and is inserted in an outer vessel containing the freezing mixture, salt and ice. Gradually the liquid reaches the freezing point—the mercury in the thermometer falls slowly at first, and then quickly until ice formation starts, and at this instant the mercury rises on account of the warmth which is liberated on the formation of the ice. The mercury remains at this higher point for a short time, and this is taken as the freezing point.

Two determinations have to be made—firstly, of the liquid under consideration, and secondly, distilled water. The difference between the two measures the molecular concentration or the osmotic pressure of the liquid. For the purpose of comparison it is obviously necessary to determine the molecular concentration of the blood and of the urine. The value for the blood (which is commonly denominated "delta"), both in the case of man and animals, is fairly constant—namely, about 0.56°; on the other hand, the value for the urine is somewhere about 1 to 2°. It is obvious that any disturbance of the function of the kidneys would make itself evident in these figures—the molecular concentration of the blood would increase, and that of the urine would decrease. A heightening of the molecular concentration of the blood above the normal by the storage up of decomposition products is very often a valuable sign of insufficient kidney activity—in short, of so-called kidney inefficiency. —From "Pathologie des Harnes," Blumenthal.

Urine testing by Cryoscopy.—B.M.J. i./o6,1063; L. ii./o6,1286.

The objection is the large volume of blood necessary. Sir A. E. Wright's method consists in determining the salt content of a fluid, *e.g.*, urine, by a comparison of the hæmolyzing power of such urine with the hæmolyzing power of varying strengths of decinormal salt solution.—L. ii./o5,1164; i./o7,975.

**Blood Pressure** is determined by some form of the **Riva Rocci Sphygmomanometer,** *e.g.*, that of **Lockhart Mummery.**

***Directions*** are supplied with the instruments. Another modification of the Riva Rocci Sphygmomanometer is that of **C. J. Martin**, which is now the leading instrument for the purpose.

The **Hæmomanometer** of **Oliver** (Registered) is another form. In this instrument the *recorder* is constructed on the principle of the 'Compressed Air Manometer,' for many years employed in measuring the hydrostatic pressure of gases, the pressure of the gas being equilibrated by the compression of the air contained in a closed tube beyond the indicator, which is thus manometrically balanced between the two compressions. A *glass tube* 8 or more inches in length and having a capillary bore, has a bulb at its upper end and a smaller bulb at its lower, where it is bent up to receive a rubber tube. Just above the lower bulb the bore is contracted; the tube is mounted on a strip of wood, through the lower end of which a pin, fixed to the sides of the box, passes, so that the tube may be raised from the *horizontal* position to a *vertical* one, before and after an observation. The *indicator* contains a few drops of absolute alcohol, coloured with blue, which does not stain the glass. Should it be allowed to dry up, it is quickly dissolved by adding a few drops of alcohol. The *compressor* consists of a strong canvas bag adherent to two small boards (12×18 cm.), through which a strong rapid screw passes.

The *Armlet* is more portable and more adaptable to the shape of the limb than those now in use (*vide* Studies in Blood Pressure, 2nd Edition, by Geo. Oliver, M.D.).

The advantages of this compressed air manometer with spirit index, are sensitiveness, horizontal scale, avoidance of leakage, index free from inertia, and much more rapid and responsive than mercurial manometers. Description of in review of Oliver's Book.—L. i./o7,1300.

**Barnard & Hill's** Instrument.—B.M.J. i/07,1253.
The *hæmomanometer* is valuable as giving a record of the contraction and relaxation of the arterial wall rather than of the blood pressure. L. i./09,451.

Evolution of *Manometers* of **Stephen Hales. Poiseuille, Ludwig, von Basch, Potain. Gaertner's** tonometer, **Riva Rocci,** and **Hill** and **Barnard's, C. J. Martin's** and **Oliver's** Modification of, *Vide* L. ii./08,1126: B.M.J. ii./09,64.

**Sphygmo-Oscillometer (Eckenstein).**—B.M.J. ii./10,1765.

**Pachon's Sphygmo-Oscillometer** gives readings considerably higher than those obtained with the Riva-Rocci apparatus.—B.M.J. ii./11,813,1472.
Two new methods (Auditory and Visual) of reading Arterial Blood Pressure.—P.R.S M., Nov. 1910, Clin. Sect., p. 8.
For **Blood Pressure,** see also *Vol. I.* p. 529.

**Viscosity of the Blood** is determined by aid of the **Viscosimeter (Du Pre Denning** and **Watson).**

**Electrical Conductivity of the Blood.**—The 'hæmo-renal salt index' is the ratio of the electrical resistance of the blood to that of the urine. In health the figure would be 3, 4, or 5, thus—

$$\frac{\text{Electrical Resistance of Blood,}}{\text{Electrical Resistance of Urine,}}\ \textit{e.g.,} = \frac{900}{225} = 4.$$

The higher the figure (other things being equal) the healthier the patient. —B.M.J. ii./06,1873.

If the index increases it indicates that the blood contains fewer salts or is richer in corpuscles and that the urine contains more salts and the functional activity of the kidney is increasing. The method is of value in surgical affections of the kidney where one kidney is chiefly affected, where there is a question as to its removal.—B.M.J. ii./08,719; L. ii./08,733.

**Coagulation time of the Blood.** Capillary tubes 6 inches long with internal diameter 1·5 mm. are filled the moment the blood flows from the finger on incision. On breaking the tube (and the column of blood) fibrin formation indicates coagulation point—the time taken is noted, *e.g.*, 7 to 11 minutes in case of the author's blood. The variation in temperature of the room is negligible.—B.M.J. ii./07,1580.

Another method, and simpler, is to drop the blood from a broken capillary tube on to a glass plate. Seal the fractured end of the tube and use the sealed end as a rod to dip from time to time into the drop of blood. Ultimately a fine thread of fibrin will be drawn up—this is the coagulation point; the time can be ascertained to a second.—B.M.J. ii./07,1774. *C.f.* also *Vol. I.* p. 238.
The value of the estimation is confirmed. There is lessened coagulability in hæmophilia. The prophylactic use of lime salts or serum injections before operations on bleeders is advised.—L. ii./09.34.

## Alkalinity of the Blood Determination.

This method depends on the appearance of a precipitate when a definite amount of Acid is added to a definite amount of diluted blood. A series of small tubes are prepared containing quantities of $\frac{N}{1000}$—Sulphuric Acid rising by 0.1 Cc. from 0.0 to 1.2 Cc., the volume in each case being made up to 2 C c. with Distilled Water. A drop (0.02 Cc.) of blood is then added to each tube, the contents well mixed, and the tube placed in a water-bath at 45° for one hour. With average human blood the tubes containing the smaller amounts of Acid show a slight opalescence, but a coarse, flocculent precipitate makes its appearance when the tubes containing 0.7—0.9 Cc. of Acid are reached. The appearance of this precipitate is considered to indicate the neutralisation point. The reaction is given equally well by fresh defibrinated, oxalated or citrated blood and by red corpuscles washed many times with salt solution. It is not given by citrated or oxalated plasma, by serum or by a solution of fibrin. It is supposed that the precipitate consists of the nucleo-protein of red cells.—J.C.S.A. ii./10,317 ex Arthur E. Boycott and R. A. Chisholm (Bio-Chem. Jl., 1910, 5, 23-31.)

**Hæmatoxylin Test Solution, U.S.** 0·2% Hæmatoxylin, $C_{16}H_{14}O_6+3H_2O$ =353·48 (356·16 I, Wts.), in alcohol. About 5 drops for a titration. Assumes yellow to orange colour in acid solution and violet to purple in alkaline. The titration is complete when the change in colour remains permanent on adding 1 drop of volumetric solution after stirring.

**Ehrlich - Biondi Stain.** *Syn.* EHRLICH-BIONDI-HEIDENHAIN MIXTURE, EHRLICH'S TRIPLE STAIN.

This nuclear stain is prepared by dissolving separately Methyl Green 1 Gm. in water 200 Cc., Acid Fuchsin 1 Gm. in water 80 Cc., Orange G. 4 gm. in water 400 Cc., and mixing afterwards. The stain is then ready for use; it is *not* to be further diluted. Sections should be allowed to stain from 6 to 24 hours. Dehydration is effected with Alcohol, and the sections are cleared with Xylol, and mounted in Xylol Balsam. Slides stained 2 to 10 minutes by this process show :—

ERYTHROCYTES, orange. NEUTROPHILE POLYMORPHONUCLEAR GRANULES, violet. NEUTROPHILE MYELOCYTES, violet. ACIDOPHILE GRANULES OF THE POLYMORPHONUCLEAR CELLS, brick red. BASOPHILES, not stained. LYMPHOCYTES. Nuclei, pale greenish blue. Cytoplasm, faint pink or grey. In disease the nuclei of the erythroblasts are greenish black. This triple stain should be distinguished from—

**Ehrlich's Triacid Stain.**

Orange G. saturated aqueous solution 12, Acid Fuchsin saturated aqueous solution 8, Methyl Green saturated aqueous solution 10, water 30, absolute Alcohol 18. Glycerin 5.

The former of these two stains is the more used. The Triacid Stain appears to be more powerful, but is perhaps less delicate.

**Ehrlich's Hæmatoxylin Solution.**

Dissolve Hæmatoxylin 1.5 gm. in Alcohol Absolute 100 Cc., and mix the solution with a 100 Cc. of saturated solution of Ammonia Alum in water to which has been added Glacial Acetic Acid 5 Cc. and Glycerin 100 Cc.

**Grenacher's Alum Carmine.** Carmine 1, Alum 5, water 100. A small amount of Phenol may be added to preserve. For nuclei and muscle staining.

**Grenacher's Hæmatoxylin Solution.**

Dissolve Ammonia Alum 45 in water 430. Dissolve separately Hæmatoxylin 2.4 in Absolute Alcohol 12. Mix and allow to stand for 14 days. Filter and add Glycerin 66 and Alcohol 90% 75 Cc.

**Delafield's Hæmatoxylin Solution** is similar.

**Mayer's Borax Carmine.** This solution is prepared by boiling Alcohol 70% with Carmine and Borax in excess, and filtering after cooling.

**Mayer's Stains: Carmalum**—Carmine 2, Alum 5, boil 1 hour with water 100, filter. **Hæmalum.**—Hæmatein [$C_{16}H_{12}O_6 = 297.84$ (300.096 I. Wts.)] 1, dissolved in Alcohol Absolute 50. Mix this solution with one of Alum 50, in water 1,000. **Acid Hæmalum** consists of the above, with 2% Acetic Acid added. **Hæmatoxylin or Kleinenberg's Hæmatoxylin Solution.** To a saturated 70% Alcohol Solution of Alum and Calcium Chloride, diluted with 6 times the amount of Alcohol of the same strength, is added Alcoholic Solution of Hæmatoxylin, until the characteristic violet colour is produced. **Paracarmine.**—Carminic Acid 1, Aluminium Chloride 0.5, Calcium Chloride 4 in Alcohol 70% 100. **Picrocarmine.**—Saturated Picric Acid solution is added to a solution of Carmine 8 Gm., in 100 Cc. of Ammonia until a precipitate commences to form.

**Perenyi's Solution** (Hardening Reagent).—Dissolve chromic acid 0.15 Gm. in water 30 Cc. and add alcohol 30 Cc. and nitric acid (10%) 40 Cc. Employed for fixing plant and animal preparations.

## Calculi.

**Urinary Calculi.**

A mineral deposit composed of concentric layers of crystallised or amorphous substance cemented together by mucus or other organic material, occurring in the pelvis of the kidney or bladder or urethra. Urinary calculi (sand, gravel or stones according to size) may be classified as follows :—

(1). Those containing a mixture of *Uric Acid with Urates*, with either little or no phosphates; (2). *Mixed calculi*,—those containing more phosphates than Uric Acid; (3). *Calcium Oxalate Calculi*; (4). *Phosphatic Calculi*—composed of Calcium Phosphate. Triple Phosphate or a combination of Calcium and Magnesium Phosphates; (5). *Calcium Carbonate Calculi*; (6). *Cystin Calculi*; (7). *Xanthin Calculi.*—Gould.

**Renal Calculi.**

***Chemical composition.***—Calcium is always the base present,—the main acid component may be Oxalate, Phosphate or Urate. The Calcium salt of each these three Acids is the most insoluble one which exists, this is the reason why it is the invariable one present in renal calculi. It is impossible to associate the 'Mulberry Stone' or 'Jackstone' always with Calcium Oxalate, the 'Pebble' with Urates, etc.

The formation of renal calculi 'has for its basis a condition of diminished oxidation in which there appear primarily Calcium Salts of incompletely oxidised bodies such as Calcium Oxalate and Calcium Urate associated with Calcium Phosphate.'

***Method of analysis.***—Determined moisture in the finely powdered stone,—this was found to be 1 to 18% max. in 24 stones examined Examined qualitatively for $NH_3$, Xanthine, Cystine, Magnesium and Sulphates —these were invariably absent. Calcium was the only base in appreciable. amount. Determined the total Nitrogen (usually about 1 to 7% as average) Determined Phosphoric Acid by treating with strong Nitric Acid (destroying all organic matter) precipitated as Ammon-phospho-molybdate, washed free from Acid, dissolved in standard Alkali and titrated back with standard acid.

In another portion (larger) separated Oxalates and Urates by treatment with Hydrochloric Acid (1 in 4), determined Uric Acid by Potassium Permanganate in the insoluble residue, threw down Calcium Oxalate along with Phosphate by adding Ammonium Chloride and $NH_3$ to the Acid Solution, filtering into a Gooch crucible, washing thoroughly until Chlorine free, dissolving in Sulphuric Acid and titrating with Permanganate. Results showed with Calculi from kidneys and ureters ; Calcium Oxalate mostly about 80 to 99%. Calcium Phosphate either none or up to 40 or even 60%, where Oxalate low. Uric Acid 1 to 10%. Two (from the bladder) out of the 24 Calculi examined were almost pure Uric Acid,—all the others contained Calcium Oxalate,—only one less than 30% and more than ⅔ of them over 70% of this salt.—Benjamin Moore, B.M.J., i/11,739.

**Urethral Calculi** formed *in situ* primatily in the prostate gland and eventually in pockets communicating with the urethra. Examination of encysted calculi in diverticula which communicated with the floor of the prostatic urethra near the neck of the bladder showed in one case Calcium Phosphate 61.5%, Calcium Oxalate 30.8%, Uric Acid 3.9%. *Case* 2.—Calcium Phosphate 94.3%, Uric Acid 1.5%, Calcium Oxalate 2.5%. *Case* 3.—Calcium Phosphate 60.91%, Calcium Oxalate 13.36%, Calcium Carbonate 5.96%. The presence of Calcium Oxalate in a calculus cannot be accepted aa evidence that it had descended from the urinary channel above. It has previously been accepted that only phosphatic stones are formed *in situ*, and that urate, uric acid and calcium oxalate stones found in diverticula must have come down the urethra from above.—B.M.J. i/12,3.

A cystinuric may pass crystals of cystin (*c.f.* p. **197**) for years and yet not suffer from cystinuria,—the mere fact of a sparingly soluble substance being present does not necessarily cause formation of a calculus,—the same applies to other varieties of urinary *calculi*,—oxalic, uric and phosphatic alike.—A. E. Garrod, B.M.J. i./11, 1416.

Distilled Water would probably produce results in renal stone far greater than Vittel Water,—the regime and regimen at baths goes a long way—B.M.J. i./11,1210.

## Casts.

In the diagnosis of the cause of albuminuria associated with the presence of renal tube casts, it is remarked that owing to improvements in centrifuges, etc., technique has become almost too perfect. Care must, therefore, be taken to distinguish sufficiency of casts to be of pathological significance from 'occasional' casts.

The matrix or groundwork of casts is a structureless material thought to be due to some kind of proteid coagulation. They consist frequently of this matrix alone, and according as they are then less or more highly refractive they are called *Hyaline* or *Waxy* respectively. The Hyaline is the commoner, but neither is characteristic of any particular disease. If renal epithelial cells are embedded in the hyaline matrix, the cast is called an **Epithelial cast**, if leucocytes or pus corpuscles, a **Leucocytic cast**; if red blood corpuscles a **Blood cast**; if bacteria a **Bacterial cast**; if fat globules (degeneration products of renal cells or leucocytes) **Fatty cast**; if non-fatty granular debris **Granular cast**. The cast may be a mixed one, *e.g.*, one part hyaline, at one end granular and at the other epithelial. On the whole hyaline casts occur in all forms of nephritic conditions, whether acute or chronic. Epithelial and Leucocyte casts point to active catarrh, Granular ones tend to occur along with Epithelial casts, but when they are alone or in association with Hyaline casts they are evidence of at least less acute mischief than are Epithelial casts, while Fatty casts come between the two. Blood casts may occur in almost any variety of renal hæmorrhage, though in association with other casts they indicate very acute inflammatory changes.—H. French, B.M.J. i./11,418.

## Cerebro-Spinal Fluid.

In examining a specimen centrifugalize or allow to stand for any sediment to deposit. Examine sediment for cells and Bacteria. Leucocytes indicate an acute process, *e.g.*, septic. Lymphocytes in excess—a chronic process such as tabes; tubercular meningitis, &c.

Red corpuscles when intact indicate hæmorrhage of meninges.

If the fluid be clear test for Globulin by Salicyl Sulphonic Acid and other Tests (*v.* p. **149**) also by Spiegler's Solution, *v.p. ibid* (and Noguchi's test for parasyphilis, p. **226**).

Inoculate broth and other media for Bacteria.

Normal cerebro-spinal fluid is clear, colourless, and alkaline; the degree of alkalinity seems to vary, but the significance of this is not known. It becomes slightly turbid when boiled; it reduces Fehling's solution, glucose being present in the proportion of 0.4 to 0.5 per cent. The glucose may disappear when meningitis develops. The fluid may become coloured. Yellow fluid may indicate tuberculous or chronic meningitis, or tumour of the spinal cord; in subdural hæmorrhage or cerebral laceration it is red, but if the trauma be some days old the colour may be dark amber. Red colour may be due to accidental contamination; coagulation in the test tube is stated to be an infallible sign of this, but such a conclusion is not always justifiable. It has been stated that bile does not appear in the fluid in cases of jaundice; one of the cases described contradicts this. Turbidity is an indication of meningitis, but the fluid may be clear in subacute tuberculous meningitis. It is clear also in extradural hæmorrhage and in cerebral tumour.

A film made from normal cerebro-spinal fluid contains very few leucocytes and many fields may be examined before one corpuscle is found. Absence of leucocytes excludes meningeal inflammation, locomotor ataxy, and superficial gumma of the brain. It does not exclude cerebral abscess unaccompanied by meningitis; this shows the value of making a leucocyte count of the blood at the time the cerebro-spinal fluid is examined.

In pathological states the number of leucocytes is increased, and in inflammatory conditions a varying number of endothelial cells may be seen.

The method of conducting rachicentesis is provided.—James Rae.—B.M.J. i./11,1424. See also Cerebro-Spinal Fever, *Vol. I* p 873, also F. W. Mott,—Cerebro-spinal Fluid—Pathology, properties, chemical alterations, Examination in Sleeping Sickness, Syphilis and Parasyphilis.—L. ii./10,79.

Diplococcus in the blood in cerebro-spinal meningitis, in addition a marked early polynuclear leucocytosis,—early slight cases can be diagnosed by these. —B.M.J. i./12,54.

Method for determining the absolute pressure of the cerebro-spinal fluid. —P.R.S.M. Clin. Section, 1911, 58.

## Chlorides in Urine.

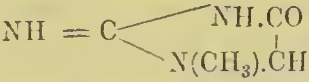
Instead of evaporating and incinerating with ammonium nitrate, oxidise the organic matter contained in 10 to 20 Cc. urine with potassium permanganate, *q.s.*, and sulphuric acid 2 Cc., warm, then neutralise with potash in presence of litmus paper. Dilute to 50 Cc. with water, add potassium chromate and titrate with silver nitrate as usual.—Allen, P.J., ii./04,8.

## Chyluria.

Opacity due to passage of chylo—the milk-white fluid absorbed by the lacteals during digestion. Thought to be caused by disordered condition of the lacteals, and is also connected with presence of filariæ. Note on a case.—L. i./07,733.

## Creatinine.

**Glycocoll-Methyl-Guanidin.**



$$NH = C\begin{cases} NH.CO \\ N(CH_3).CH_2 \end{cases}$$

or $C_4H_7N_3O = 112{\cdot}34$ (113·086 I. Wts.).

To test for the presence of this body add a little Sodium Nitro-Prusside and Caustic Soda. A red colour develops which fades on boiling the mixture. If a little Acetic Acid be added to the boiling liquid, Prussian Blue is produced.

Retarding effect of Creatinine, Creatine and Mucin on the precipitation of Cuprous Oxide from Fehling's Solution. Urates have auxiliary effect.—L. ii./06,1136; ii./07,290.

[The red colour produced with **Jaffe's Colorimetric Method of estimating Creatinine** is due to the reduction of the picric acid in alkaline solution to a mixture of amido-dinitro-phenol (picramic acid) and diamido-nitro-phenol, the alkaline salts of which are deeply coloured. The colouration is due to a somewhat complex reducing action and the conditions must be carefully specified. Temperature and time are important.—*Vide* Chapman, Int. Cong.

In determining Creatin or Creatinine add 30 Cc. of 1·2% Picric Acid Solution. It is advisable to allow to stand 5 minutes after adding the reagents, then read result.—Cook. *ibid.*

Excretion of Creatinine in diabetes mellitus.—There appears to be some connection between carbohydrate metabolism and the Creatine-creatinine metabolism. Experiments with diabetic urines showed that Creatinine was not increased to any extent even when patients were on a highly nitrogenous diet. Creatine on the other hand, a substance never found in the normal urine if the diet be free from Creatine and Creatinine was always found,—even when patient was on a Creatine-Creatinine-free diet.—B.M.J. ii./10, 1343.

## Cystin.

$(CH_3—C.NH_2.S—CO.OH)_2 = 238.5$(240.276 I. Wts.).

**Cystin** is a cleavage product of protein-metabolism, apparently loosely bound and easily split off at an early period of the intestinal digestion. Normally it becomes oxidised and hence is unrecognisable, but in cystinuria it is excreted unchanged.

*Separation of Cystin.* Free from oxalates and phosphates by Ammonia and subsequent addition of Calcium Chloride until this no longer precipitates, add equal volume of Acetone and Acetic Acid in slight excess. Cystin crystallises out in 3 or 4 days, and may be purified by dissolving in Ammonia and reprecipitating.—Mann, p. 61.

Is occasionally found in urinary deposits as transparent six-sided crystals—insoluble in alcohol but soluble with ease in mineral acids, caustic alkalis and ammonia. Uric acid occasionally crystallises in similar form, but gives the murexide reaction; Cystin does not.

Recent research on some problems of urinary excretion.—L. i./06,674.

Cystin Calculi two cases.—B.M.J. i./07,489.

Garrod on Cystinuria.—L. ii./08,142,214. These lectures should be consulted by those desirous of recent information on the subject.

## Faeces, Examination of.

This is undertaken to determine the state of the various digestive functions, and to assist thereby the treatment of gastric and intestinal disease.

A trial diet is necessary. Various 'meals' have been suggested with the inclusion of Carmine, Carbon, etc., to mark the commencement. The author of this paper advises, however, ordinary meals during 48 hours as follows, to include (1) Milk undiluted or mixed with coffee, (2) Eggs, (3) Animal food such as fish, poultry, veal, beef, etc., (4) farinaceous foods,—bread, potatoes, rice, (5) the various green vegetables and roots, (6) stewed fruit, (7) butter and various fats of meat.

The fæces are collected in a glass vessel,—this permits macroscopic examination (**constipation**, etc.).

**Bile**, Secretion of. Stir a portion with concentrated aqueous Perchloride Solution. Normally after some hours all the portions containing *hydrobilirubin* take on red colour, while those containing *bilirubin* take on green. An indistinct reaction shows that bile secretion is inhibited.

**Fermentation.**—Set aside a portion in a Schmidt's fermenting flask.

Distinct gas evolution in twelve hours shows that **Starch digestion** has not been satisfactory. The fæces in this case are distinctly acid—catarrhal affections of the small intestine. Gas evolution after 24 hours or later shows that the albuminous substances are being split up by the increased alkalinity of the fæces. In the former case there is **intestinal fermentation dyspepsia** and in the latter **intestinal decomposition dyspepsia.**

**Fats.**—All that is necessary is to determine the proportion of *split up* to *total fat*. The splitting up of fats takes place in the small intestine. One determines how much of the total fatty substance present in the fæces appears as *neutral fat*, how much as *soap*, and how much as *fatty acid*. Extract 2 to 3 Gm. in a Soxhlet with Absolute Alcohol then with Chloroform for six hours. The residue on evaporation contains *all the fats*. Titrate with Alcoholic $\frac{N}{10}$ KOH. Result—Fatty Acid + Soaps—the triglycerides being calculated as Stearic Acid, the No. of Cc. of Alkali X 0.0284 gives the amount in Gm. of fatty acid and soaps (Acid Stearic M.W. = 284). The difference between total fat and fatty acid = neutral fat. About 75% of the fats ingested should be split up into soaps and fatty acids and the more the dissociation differs from the normal the greater the amount of neutral fats formed. The average amount of fat taken in health is 125 Gm. *p.d.* This would correspond normally to about 20 Gm. of total fat in the fæces. *The greater the amount of total fat the more defective the fat absorption.*

**Blood.**—The Aloin Test is the only satisfactory one.

About 5 Gm. of the mixed fæces are well ground up with water and poured into a large test tube. The fat is removed by shaking with an equal volume of Ether. The residue is well shaken with one third its volume of Glacial Acetic Acid and about 10% of Ethr, and allowed to stand for about 15 minutes. Meanwhile the Aloin Solution is prepared by dissolving a knife-point of Barbados Aloin in about 5 or 6 Cc. of 70% Alcohol, shaking and allowing it to stand until clear (freshly prepared for each test). The Acid Ether Extract is poured off the fæces, and 2 or 3 Cc. mixed with an equal volume of the clear yellow Aloin Solution. Add 2 or 3 Cc. of old (ozonated) Turpentine (besides being old the Turpentine should not have stood in the sunlight, as it may then give a reaction alone) and gently shake the mixture. In the presence of blood a pink, deepening to a cherry red colour appears, either in the mixture as it is shaken, or in the Aloin Solution as it sinks to the bottom on standing. A time limit of 15 minutes is advisable for the appearance of the colour,—non-appearance after the lapse of this time to be taken as negative.—B.M.J. ii./10,409.

**Microscopic Examination.**—The presence of *connective tissue* and *elastic fibres* indicates a defect in acidity of the gastric juice. Defective dissociation of connective tissue and coagulable proteins points to a primary gastric affection known as *achylia gastrica* (*Hayem's hypopepsia*). Appearance of elastic fibres, if not associated with connective tissue and coagulated protein, must be regarded as a sign of good gastric, but defective intestinal digestion. Considerable amount of undigested muscle fibre with well-marked contour may indicate bad intestinal digestion of meat.

For Detection of *B. Tuberculosis* in, by Antiformin, *v.p.* **248**.

**Cereal products, Vegetables, etc.**, can be recognised microscopically.

**Starch.**—Lugol's Solution detects. When unchanged and clumped together there is *deficient pancreatic enzyme*. On the other hand, *swollen granules* almost always indicate *catarrhal affection* of the small intestine where the digestion of the starches chiefly takes place.

**Mucus.**—Stain smear with 1% Sodium Alizarin Sulphate. Normal mucus appears as small flakes and scales faintly yellow. It is possible to determine the section of the intestine from which the mucus is derived by the tint of this colour,—*the further the distance from the anus the mucus has to travel the lighter the colour.*—O. Kraus, L. ii./10.95. *See also* L. i./06,1683.

## Formaldehyde in Urine.

We recently had occasion to conduct some examinations of Urine for formaldehyde to determine (?) excretion after administration of Urotropin and allied bodies. We found the following of service :—

### Phloroglucin Test.

To 5 or 10 Cc. of sample add 5 drops of 1% Aqueous Solution of Phloroglucin followed by 5 drops of 30% Caustic Soda Solution. Red color appears if formaldehyde present.

Will show 1 in 2,000,000 of Water and 1 in 50,000 of urine.

(Shows no color with Hexamethylenetetramine).

**Rimini's Test.**

To 5 or 6 Cc. of sample add 1 drop of 1% Aqueous Solution of Phenylhydrazine, then 1 drop of 1% Aqueous Solution of Sodium Nitroprusside and 5 drops of 30% Caustic Soda Solution.

Blue color appears if Formaldehyde be present.

Will show 1 in 75,000 of water and 1 in 100,000 of urine.

(Shows no color with Hexamethylenetetramine).

**Meta Test (W. H. M.).**

To 10 Cc. of sample add 0.05 Cc. of 5% Aqueous Solution of Meta-diamidobenzol Hydrochloride.

Gives a yellow color or precipitate if Formaldehyde present.

Will show 1 in 20,000 of *water* by color and 1 or 2 in 10,000 of *urine by* opalescence or precipitate.

(Gives no reaction with Hexamethylenetetramine).

The 'Meta' Test in conjunction with the others may prove of value in search for Formaldehyde in Formalin poisoning, *e.g.*, with preserved milk or food.

## Glucose Tests.

On the presence of sugar in healthy urine as a source of the Osazone Reaction.—Pavy and Bywaters, with replies by Cammidge :—

The sugar can be isolated from normal urine and confirmed by fermentation test. Directions are given for detecting by Osazone direct in normal urine. *The sugar may amount to as much as* 0.25% *or more in normal circumstances. The formation of osazone from a 'suspected' urine is therefore nothing more than a natural occurrence.* The Ammonio-Cupric method advised. The reducing power of Creatinine and Uric Acid is a small fraction,—about $\frac{1}{5}$ of the reducing power ordinarily met with. Difficulty of defining a 'healthy' urine under modern conditions. Sugar is acknowledged to be universally present in the blood, and hence it is argued must also be present in normal urine.—B.M.J. ii./10,78,176.229,296,353.

**Alimentary Glycosuria** occurs when the limit of assimilation for the individual is reached. Breul gave 200 Gm. of grape sugar to a man and examined the urine during the succeeding 4 hours. When at rest he excreted 2.14 Gm., when at work 0.09 Gm.—Mann.

**Phloridzin Glycosuria.** This was first observed by Mering who by giving 1 Gm. of Phloridzin night and morning, produced the daily excretion of nearly 100 Gm. of glucose in the urine. In phloridzin glycosuria there is no increase of glucose in the blood. According to one hypothesis the phloridzin is split up in the kidneys into sugar, and phloretin, *vide ibid.* p. 74 for further consideration of the subject. Also our own page **30**, and *Vol.* I. p. 833.

**Renal Glycosuria** is due to an abnormal excretion of the sugar normally present in the blood.

In **pathological glycosuria** the sugar may be formed in the system from other carbohydrates, but also from alimentary and systemic proteins and fats. Much discussion has arisen on this subject Some claim that sugar cannot be derived from proteins containing no preformed carbohydrate molecule.

Diabetic and non-diabetic glycosuria, *i.e.*, the dangerous disease diabetes in which oxybutyric acid (*q.v.* p. 142) and its derivatives are passed, designated 'composite diabetes' and in which coma may set in; and the relatively harmless alimentary glycosuria have to be distinguished.—B.M.J. i./03,667; L. i./06,676. Significance of small quantities of sugar.—B.M.J. i./06,126.

DELICACY OF VARIOUS TESTS :—

| | |
|---|---|
| Fehling's Solution will indicate | 0.0008% |
| Tommer's ,, ,, ,, | 0.0025% |
| Nylander's ,, ,, ,, | 0.025% |
| Fermentation ,, ,, | 0.1 to 0.5% |
| Phenylhydrazine ,, ,, | 0.025 to 0.05% |
| Polarimeter ,, ,, | 0.025 to 0.05% |

B.M.J. i./07 1472, *q.v.*

**Fehling's Solution**, Potassio - Cupric Tartrate Solution (*Off.*).

*Glucose* being an aldehyde has strong reducing action. In the test the alkaline glucose-cupric oxide when heated causes deposition of the cuprous oxide. 1 molecule of Glucose reduces as nearly as possible 5 molecules of Cupric Oxide.—Mann.

In making use of Fehling's Solution it is important when looking for small quantities of sugar to dilute the urine to about Sp. Gr. 1·015. Mix with an equal volume of Fehling's Solution. Boil for a few seconds—if no precipitate within two minutes there is no sugar of pathological import. For Life Insurance purposes the Alkaline Safranine test (*q.v.*) deserves to come more into use.—L. i./06,1136, *et seq.*, *vide* also B.M.J. i./07,1471.

**Fehling's Solution** is prepared in two solutions:—No. 1. Copper Sulphate 34·64, Sulphuric Acid 0·5, Distilled Water to 500.

No. 2. Sodium Hydroxide 77, Sodium Potassium Tartrate 176, Distilled Water to 500.

Mix equal volumes when required. Of this, 10 Cc. will be decolourised and reduced by 0·05 Gm. (or 53 minims = ¼ grain) of glucose or diabetic sugar in solution, with precipitation of yellowish red cuprous oxide, when the two are boiled together. No. 2 solution should not be kept in a very cold place, or it may crystallise. By keeping the copper solution separate from the alkaline solution the test is prevented from becoming erroneously sensitive.

A curve or chart is arranged showing proportion of Glucose when working with 30 minims of Fehling's Solution. 'Mass' action explains the deposition of the Suboxide in bright red as distinct from the yellow condition.— L. i./09,680. *Vide* also our table for figures using **Gerrard-Fehling Solution.** The figures there given apply exactly as if 10 Cc. of 'Fehling's' had been used in place of the Gerrard's Solution.

A little Calcium Carbonate or Barium Sulphate greatly assists the deposition of the cuprous oxide and enables the colour of the supernatant liquor to be more easily seen.

**Cupric Pellets,**—the salts of Fehling's Solution are prepared compressed into tablets.

**Glass Capsules,** containing about 1 Cc. of Fehling's Solution, are also prepared.

**Glucose ✱ Endolytic Tubes** are prepared—use similar to those for Albumen *q.v.*

The reaction may be obtained in the cold or by pouring boiling water on to the charged tube (sealing is not necessary). Or, indeed, if not available a ighted vesta drawn carefully along the tube will suffice. If done in the cold, sealed tube to be inspected for usual cuprous oxide precipitate after 12 to 24 hours.

**Glycuronic Acid** $C_6H_{10}O_7$=192·62 (191·01 I. Wts.), Uric Acid, Creatinine, Pyrocatechin, Hydroquinone (*see Vol. I.*, p. 821), Salicylic Acid Compounds, Chloral, Chloroform and similar bodies reduce Copper Solutions, these may be removed by simple repeated **filtration** through **animal Charcoal.** None of these bodies **ferment** or give **Osazone Crystals.** *Vide* Phenylhydrazin, *infra* and p. **175**).

Glycuronic Acid is closely allied to the Pentoses. It conjugates with **phenol indoxyl** and **skatoxyl**, and normally occurs chiefly as phenolglycuronic acid in combination with potassium.—Mann, p.87 ; Detection of, 100.

Glycuronic Acid can be distinguished from Glucose by fermentation and the phenylhydrazin tests.—L. ii./06,1136.

Creatinin most markedly of all substances interferes with Fehling's Test—it holds the otherwise precipitable Cuprous Oxide in solution not indirectly by producing Ammonia as Pavy thought.—L. i./08,85. *C.f.* also B.M.J. i./07,1472. Creatinin to extent of 3 mgr. per Cc. may be present in normal urine.—L. i./06,779.

***"Fehling" is reduced*** by dextrose, levulose mannitose, milk sugar, galactose, arabinose, aldehyde, chloral, chloroform, valeraldehyde, resorcinol pyrogallic acid, gallotannic acid, trichloracetic acid, arsenious anhydride, and similar reducing-bodies, glucosides, and acetone.

**Formaldehyde** being an Aldehyde like Glucose *also reduces.*—should not be used to preserve urines for examination as to diabetes. If in doubt as to presence of Formalin for any reason boil with excess of Strong Ammonia Solution before conducting Fehling's test. Another reason for refraining from its use is that Formalin combines with Urea forming crystals on the side of the container not unlike Leucin.—B.M.J. ii./10,1164,1289,1343.

***"Fehling" is not reduced*** by mannite, dulcite, sucrose, inosite, cellulose,dextrin, arabin, alcohol, glycerin, phenol, benzaldehyde, salicylaldehyde acetic lactic, oxalic, succinic,tartaric, citric, gallic, saccharic, mucic, gluconic acetonic, benzoic, salicylic, and sulphurous acids, and alkaloids.—Allen's Urine Analysis.

Uric Acid and urates, theine and theobromine have no retarding influence on the precipitation of Fehling's Solution.—L. ii./06,1136.

An orange precipitate formed when hot urine is mixed with hot Fehling's Solution without reboiling, affords almost conclusive evidence of presence of a hexose monosaccharide such as glucose or lævulose.

An orange precipitate formed on boiling is sometimes due to presence of a compound glycuronate. ***To make certain of Glucose the urine*** must contain ***a + rotatory reducing substance, fermented by yeast*** (both Glucose and Lævulose are), it must yield ***an Osazone of the correct crystalline form melting at slightly above 200°C*** (both Glucose and Lævulose give) and finally it must yield ***no Osazone*** in case of Glucose ***with Methylphenylhydrazine,*** which with Lævulose yields one melting at 150° C.—A. E. Garrod, L. i./12,484.

**Ammoniated Cupric Test (Pavy).**

| | | |
|---|---|---|
| Tartarated Soda, and Caustic Potash, of each 178 grains. | | |
| Distilled water ... ... ... ... ... ... ... .. | | *q.s.* |
| Dissolve and add in aqueous solution | | |
| Copper Sulphate ... ... ... ... ... ... ... | | 36½ grains. |
| When cold add | | |
| Strong Solution of Ammonia, Sp. Gr. 0·88 ... ... ... | | 6 ounces. |
| Distilled Water... ... ... ... ... ... ... | to | 1 pint. |

This solution is not hyper-sensitive. Ammonia is a solvent for the cuprous oxide, yet it does not interfere with the reduction of the oxide in sugar testing. 10 Cc. of the solution further diluted are kept boiling in a flask, air being excluded, while the urine *q.s.* is added to discharge the colour; this solution is one-tenth the strength of Fehling's solution, 10 Cc. of it are equivalent to 0·005 Gm. Glucose.

**Glass Capsules** containing 10 Cc. of this solution are prepared.

**Fehling's Test, Allen's modification.**—For small quantities of sugar in urine. Heat 8 Cc. of the urine to boiling point and add 5 Cc. of the copper solution, cool and add 2 Cc. saturated solution of sodium acetate, slightly acidified with acetic acid, to complete precipitation of uric acid, phosphates, and xanthine. Filter, add 5 Cc. of the alkaline solution, and boil for a few seconds. If more than 0·25 per cent. of sugar be present, cuprous oxide is precipitated before boiling point is reached, but if less than this proportion, it is deposited during cooling.—Analyst, xix. 178 ; P.J.ii./95, 307.

**Purdy's Test :—**

Dissolve Copper Sulphate 4.752 in Glycerin 35 and Water 200 with gentle heat. In another 200 of Water dissolve Caustic Potash 23.5. Mix the solutions and when cooled add Strong Ammonia Solution 350 and dilute with Water to 1,000.

Dilute 35 Cc. to about 100 Cc. with Water, boil in a flask and run in the urine, —(diluted 4 times if Glucose over 5% or diluted twice if over 2%) until color begins to fade, *then slowly, until colourless.* The cuprous Oxide in this test remains dissolved. The number of Cc. of actual urine used = 0.02 Gm. Glucose. —Purdy, "Practical Uranalysis and Urinary Diagnosis."

**Barfoed's Reagent.**—Neutral Copper Acetate (*q.v.*) 13·3, Acetic Acid solution (1 per cent.) 200. A Glucose solution warmed with a small quantity of this precipitates Cuprous Oxide.

**Fermentation Test.**—A useful confirmatory test. Prior to conducting, determine the specific gravity of the urine as exactly as possible. Then fill a Doremus tube completely with the specimen ; place a little fresh yeast in the bend; keep in a moderately warm position for 24 hours. If sugar be present, carbon dioxide will be produced, and the gravity of the urine will fall—each degree of density lost being equivalent approximately to 1 grain of glucose per ounce. Is stated to be untrustworthy for small quantities.—L., ii./'06,1136, *et seq.*

### Ⓑ Gerrard's Solution.

This is prepared by diluting 100 Cc. mixed Fehling Solution with about 300 Cc. of water and almost decolourising, whilst boiling, with 5% solution of Potassium Cyanide (about 63 Cc. are required), and making up the volume when cold to 500 Cc.

**For the Estimation of Sugar by this Process.**—Mix 50 Cc. of the solution with 10 Cc. of mixed Fehling's Solution (5 Cc. Fehling's No. 1, and 5 Cc. Fehling's No. 2). Boil in a basin and pour into it, whilst boiling, diluted urine, ½ to 1 Cc. at a time by means of a burette, until the blue colouration just disappears, taking care not to add an excess. An average diabetic urine may be diluted 1 with water to 10.

The calculation is then simple—as in the case of the Fehling method :—

The number of Cc. of actual undiluted urine used contains 0·05 Gm. of Glucose. From this the "percentage"—grammes per 100 Cc.—is easily obtained. To convert this into grains per fl. oz. multiply by 4·375.

This product multiplied by 20 gives the number of grains of Glucose per pint. The following table will be found useful:—

| | No. of Cc. of diluted Urine used. | Gm. Sugar per 100 Cc. | Grains per fl. oz. | Grains per pint. |
|---|---|---|---|---|
| Urine diluted 1 with Water to 10 | 4·0 | 12·5 | 54·69 | 1093·80 |
| | 4·5 | 11·1 | 48·56 | 971·20 |
| | 5·0 | 10·0 | 43·75 | 875·00 |
| | 5·5 | 9·1 | 39·86 | 797·20 |
| | 6·0 | 8·3 | 36·35 | 727·00 |
| | 6·5 | 7·7 | 33·73 | 674·60 |
| | 7·0 | 7·1 | 31·10 | 622·00 |
| | 7·5 | 6·7 | 29·35 | 587·00 |
| | 8·0 | 6·3 | 27·59 | 551·80 |
| | 8·5 | 5·9 | 25·84 | 517·80 |
| | 9·0 | 5·6 | 24·97 | 499·40 |
| | 9·5 | 5·3 | 23·21 | 464·20 |
| | 10·0 | 5·0 | 21·90 | 438·00 |
| | 10·5 | 4·8 | 21·02 | 420·40 |
| | 11·0 | 4·5 | 19·71 | 394·20 |
| | 11·5 | 4·3 | 18·83 | 376·60 |
| | 12·0 | 4·2 | 18·40 | 368·00 |
| | 12·5 | 4·0 | 17·52 | 350·40 |
| | 13·0 | 3·8 | 16·61 | 332·20 |
| | 13·5 | 3·7 | 16·21 | 325·20 |
| | 14·0 | 3·6 | 15·77 | 314·40 |
| | 14·5 | 3·4 | 14·86 | 297·20 |

| | No. of Cc. of diluted Urine used. | Gm. Sugar per 100 Cc. | Grains per fl. oz. | Grains per pint. |
|---|---|---|---|---|
| Urine diluted 1 with Water to 2. | 3·0 | 3·30 | 14·45 | 289·00 |
| | 3·5 | 2·90 | 12·70 | 254·00 |
| | 4·0 | 2·50 | 10·95 | 219·00 |
| | 4·5 | 2·20 | 9·64 | 192·80 |
| | 5·0 | 2·00 | 8·76 | 175·20 |
| | 5·5 | 1·80 | 7·88 | 157·60 |
| | 6·0 | 1·70 | 7·45 | 149·00 |
| | 6·5 | 1·50 | 6·57 | 131·40 |
| | 7·0 | 1·40 | 6·13 | 122·60 |
| | 7·5 | 1·30 | 5·69 | 113·80 |
| | 8·0 | 1·25 | 5·49 | 108·80 |
| | 8·5 | 1·18 | 5·17 | 103·40 |
| | 9·0 | 1·11 | 4·86 | 97.40 |
| | 9·5 | 1·05 | 4·60 | 92·00 |
| | 10·0 | 1·00 | 4·38 | 87·60 |
| | 10·5 | 0·95 | 4·15 | 83·00 |
| | 11·0 | 0·91 | 3·96 | 79·20 |
| | 11·5 | 0·87 | 3·81 | 76·20 |
| | 12·0 | 0·83 | 3·64 | 72·80 |
| | 12·5 | 0·80 | 3·50 | 70·00 |
| | 13·0 | 0·77 | 3·37 | 67·40 |
| | 13·5 | 0·74 | 3·24 | 64·80 |
| | 14·0 | 0·71 | 3·11 | 62·20 |
| | 14·5 | 0·69 | 3·09 | 61·80 |
| | 15·0 | 0·67 | 3·00 | 60·00 |

The four columns on the right in above table give the results with the urine diluted with an equal volume of water. If the urine contains less sugar than this, it is desirable to use it in an undiluted condition.

The calculation is then as before: the number of Cc. of actual urine used contain 0·05 Gm. of Glucose.

Two modifications of Fehling solution, by S. R. Benedict. Sodium Carbonate is employed instead of Caustic Alkali. E. F. Harrison's notes on,—P.J., ii./11,746.

**Gowers' Test** for roughly estimating glucose:—

Dilute with an equal volume of Liquor Potassæ, this makes all urine pale enough to prevent important error in such a rough test. Boil the upper half well but not too long—a lemon tint corresponds to about 5 grains per fluid ounce, a pale sherry to 10 grains, a dark sherry to 15 grains, and a port wine tint to 20 grains and upwards.—*Vide* Brunton on "Diabetes," Reynolds' System of Medicine, Vol. V., 1879, p. 396.

The method can be made quantitative.—L. i./07,1446. Gowers' note on.—L. i./07,1673.

**Johnson's Test.**—*See* Picric Acid, p. **175**.

### Nitropropiol. Sodium Orthonitrophenylpropiolate.

$C_9H_4Na(NO_2)O_2$=211·53 (213·042 I. Wts.).

Has long been used for detection of sugar in diabetic urine. Owing to reduction, Indigo blue colour is produced, or indigo-blue itself precipitated. Tablets are prepared. This re-action is based upon Bayer's synthesis of indigo-blue (*q. v.*), which is briefly:—Cinnamic Acid → Orthonitrocinnamic Acid → Dibromo compound of → Orthonitrophenylpropiolic Acid, which, warmed with alkali, in the presence of Glucose decomposes thus:—$2C_9H_5(NO_2)O_2 = C_{16}H_{10}N_2O_2$ (Indigo Blue) + $2CO_2 + O_2$. This substance is to be distinguished from Sodium phenyl-propiolate (*Syn.* Thermiol), *v.* *Vol I.* p. 26. For testing permeability of the kidney with Indigo-carmine, *v.* p. **29**.

**Solution of Sodium o-Nitrophenylpropiolate** is employed of following composition: Place 5 Gm of o-nitrophenyl-propiolic acid in a mortar and wash alternately with 1 to 2 Cc. of water and 1 to 2 Cc. of 10% Sodium Hydrate Solution until dissolved (altogether about 8 to 10 Cc. required). Dilute to 1 litre. On boiling 5 Cc. with 1 Cc. of Urine blue colour of indigo appears either immediately or in ½ minute according to amount of glucose.—M. '08,116.

**Nylander's Reagent.**

Bismuth Subnitrate 2, Rochelle Salt 4, Sodium Hydroxide Solution (8°/o) 10 and **Almen's** re-agent consisting of Bismuth Subnitrate 1, Rochelle Salt 2, Potassium Hydroxide Solution (35% strength) 50, are used for detecting Glucose. A small quantity of either warmed with the urine will blacken if glucose be present.

**Phenyl-hydrazine Hydrochloride**, $C_6H_5.NH.NH_2.HCl = 143·53$ (144·552 I. Wts.), is used as a test for sugar. It is in colourless, shining, crystalline scales; and should be free from azo-compounds. A small quantity is warmed with twice its weight of sodium acetate in solution, an equal volume of the suspected solution added, and boiled for 20 minutes. On cooling, yellow crystals of phenyl-glucosazone, $C_6H_{10}O_4\ (N_2H.C_6H_5)_2 = 355·66$ (358·216 I. Wts.), are deposited if sugar be present.—B.M.J. i./10, 453,454; L. ii./04,211,329,564.

This substance should be handled with care as it may produce eczema.—Brit. Jl. Dermatology, Aug. 1905.

Boil 2 to 3 Cc. of the urine with equal quantity of water and phenylhydrazine hydrochloride 0·1 Gm. and Sodium Acetate 0·5 Gm. Add 10 Cc. of Sodium Hydrate 10% solution, invert test tube a few times and allow to stand. A pink to red colour of the whole liquid in 5 minutes indicates sugar of clinical significance.—B.M.J. ii./07,19.

(Acetyl-Phenylhydrazin. *Syn.* Pyrodin, Hydracetin. *Dose.*—½ to 3 grains is antipyretic and analgesic. 10% ointment in parasitic skin diseases.)

**Picric Acid.** JOHNSON'S OR BRAUN'S TEST. This has been suggested as a test for Glucose in urine, as a solution of this sugar, if boiled with Picric Acid and Solution of Potash, reduces the yellow Picric Acid to the deep red Picramic Acid, $C_6H_2(NO_2)_3OH + 9H_2 = C_6H_2(NH_2)_3OH + 6H_2O = 138·16$ (139·102 I. Wts.) forming Potassium Picramate (M.W. 175·99) 177·194 I. Wts.), the depth of colour depending on the amount of sugar. By the aid of **Johnson's Picro-Saccharometer** this reaction is made a quantitative test.

Solution for use with same: Strong Solution of Ferric Acetate (B.P.'85) 15 drachms, Glacial Acetic Acid 7½ ounces, Ammonia Solution 0·959, 3¾ ounces. Water to 3 pints.

**Safranine Solution.**—1 in 1,000. One volume of this, with one of urine and one of liquor potassæ is heated to boiling, avoiding agitation. If the urine contain sugar to the extent of 0.1% the liquid will be decolourised. (On cooling color may return in proportion to the amount of sugar present). Each additional volume of the safranine solution that may be decolourised represents roughly 0·1°/o of sugar.—L. i./95,314.

Safranine Solution (unlike Fehling's Solution) is unaffected by Creatine, Creatinine, Uric Acid and Urates. The test deserves to be better known.—L. ii /06,1198. It is only slowly affected by albumin.

For estimation of glucose by **polarisation** see Mann, p. 109.

**Bromo-Methyl Furfural Test.**—Pour 5 Cc. of the liquid on to an excess of solid anhydrous calcium chloride so as to form a semi-solid, or pasty, mass. Add to this 10 Cc. of toluene containing two or three drops of phosphorus tribromide and then carefully boil the mixture for a few minutes, bearing in mind the inflammable nature of toluene. Pour off the toluene solution, and, after cooling, add to it about 1 Cc. of malonic ester and a little alcohol. On neutralising the mixture by adding alcoholic potash drop by drop, a characteristic pink colour will usually be observed. The mixture is now considerably diluted with alcohol and a few drops of water, when, if sugar was originally present, the solution will exhibit a beautiful blue fluorescence.—L. i./07,215.

**Alkaptonuria** (rare), due to presence of Di-oxyphenyl-acetic Acid $C_6H_3(OH)_2CH_2.COOH = 166·8$ (168·064 I. Wts.). Urine reduces Fehling's

Solution, and turns brown with alkali. See also Mann (p. 213) *q.v.* also for ochronosis (p. 215) and melanuria (p. 217).

A case.—L. i./07,660. Of 31 cases of alkaptonuria 15 were in children of first cousin marriages.—Garrod, L.ii./08,5.

Alkaptonuria occurring with pityriasis rubra.—P.R.S.M. Derm. Sect March 1910, p. 60.

**Laevulose** reduces Fehling's Solution, ferments with yeast, forms an osazone with Phenylhydrazin like glucosazone. *Vide* also **Org. Anal. Chart.** Occassionally found in urine alone—more commonly with dextrose. For details of causes, effects and cases see Mann. For *detection vide ibid*, p. 97.

For **Lactose, Maltose** and **Isomaltose**, and **Heptose** *q.v. also.*

## Pentose.

**Bial's Test** (P.G.V.)—Orcin 1 Gm. in 500 Cc. of 30% Hydrochloric Acid containing 25 drops of Ferric chloride Solution.

Method of use.—4 Cc. are heated in a test tube to boiling—then add not exceeding 1 Cc. of the specimen. If pentose present, green colour either at once or shortly. Glycuronic Acid does not interfere.—Mann.

Pentose reduces Fehling's Reagent but is not fermentable. It occurs after excess of fruit such as plums and cherries. Pathologically it occurs in morphia habit.

NOTE.—**Orcin.** *Syn.* Methyl Resorcin, Dioxytoluol 1:3:5 $C_6H_3(CH_3)(OH)_2+H_2O=141.01$ (142.08 I. Wts.). White crystals turning pink. Very soluble in water and alcohol. Has antiseptic properties but used mostly as test.

**Orcein.**—$C_{28}H_{24}N_2O_7=496.52$ (500.212 I. Wts.) Prepared from the above. Reddish powder, soluble in Alcohol with red colour with violet color in alkalis, used as mordant in flagella staining and for demonstrating elastic tissue in sputum.

## Glycerin.

**Glycerin** in the urine is claimed to be indicative of pancreatic disease, and to result from the decomposition of fat. For the method of detection, which depends on the formation of crystals with phenylhydrazin, *vide* L. i./04,783; L. i./05,14. Value of Cammidge's Test questioned. At any rate the urine must be perfectly fresh.—B.M.J. i./06,433. Chronic pancreatitis with notes of examinations of the urine, blood and fæces by Cammidge.—L. ii./05,1824.

Value of Cammidge's Reaction in diagnosis. The characteristic needle-shaped crystals can be obtained from the urine in pancreatitis, acute and chronic. In malignant disease they are found only in about a quarter of the cases, and in these a zone of inflammation probably surrounds the cancerous area.—B.M.J.ii./09,937.

The reaction is one of a number of urine reactions which may accompany elementary error. Diagnostic power of the reaction not confirmed.—W. Russell, B.M.J. ii./10,5.

Cammidge records results of over 1,500 samples examined. 13 cases (all those examined) of acute pancreatitis gave the test, also in 56% of the cases (204 in number) of chronic pancreatitis associated with gall stone, also in 52% (of 403 cases) of chronic pancreatitis due to secondary disease of the intestine—infection probably of the pancreatic ducts from the duodenum. Analysis of the faeces is also required to gauge the extent and often the nature of the pancreatic mischief and to obtain confirmatory indications as to the cause. Taken in conjunction with clinical symptoms the reaction gives a trustworthy diagnosis of pancreatic disease.—P.J.Cammidge.—B.M.J. ii./10.8. See also chronic pancreatitis with special reference to diagnosis and treatment.—L. i./11,1494.

Cammidge Reaction in 1475 cases (Cammidge).—P.R.S.M. Med. Sectn. 1910, p. 163.

Experimental investigation into origin and cause of the Cammidge Reaction in the urine.—P.R.S.M., Path. Sectn. Feb. 1910, p. 79.

## Hippuric Acid.

Syn. Benzoyl-glycocoll, *vide* Vol. 1, p. 6.

Hippuric Acid is excreted daily to extent of about 0.5 to 1 Gm. on mixed diet or it may reach 2 or 3 Gm. on vegetarian diet. It is formed by the interaction of dehydrated Benzoic Acid and Glycocoll in the system. Protein in the intestines produces amino-acids which are oxidised to benzoic acid. **Glycocoll** is a normal product of metabolism, and by this reaction renders the benzoic acid (*inter alia*) harmless,—this occurs, it is thought, in the kidneys.

1 of the free acid in 55,000 of water will change Congo red paper to blue, but urine does not cause the change—showing that the Hippuric Acid that is present is in the combined condition.

## Indican.

**Indican**, Potassium Indoxyl Sulphate, $C_8H_6NSO_4K = 249{\cdot}39$ (251·228 I. Wts.), may be detected by **Ehrlich's Test**: a Solution of 0·33 Gm. of Dimethylamidobenzaldehyde in water and strong Hydrochloric Acid of each 50 Cc.

Boil the urine with an equal quantity of this solution. Cool and render alkaline with Ammonia or weak Potash Solution. If Indican be present a red colour results.

**Jaffe's Test.**—Indican may also be detected by adding to the specimen an equal volume of strong Hydrochloric Acid, and adding drop by drop concentrated Liquor Calcis Chlorinata; blue colouration, due to Indigo, if Indican present, which may be taken up by shaking with Chloroform. If shaken with Ether this solvent will dissolve the Indigo-red.

Care must be taken not to use too much of the bleaching liquid or the indigo blue may be changed to indigo white.—B.M.J. ii./08,867.

The addition of hydrochloric acid and shaking with Chloroform in cases of persons treated with Iodides is almost certain to give violet colour; add a crystal of sodium hyposulphite to prevent confusion.—L. ii./06,1459.

**Indol**—in fæces. Dimethylamidobenzaldehyde is test for. Centralblatt fur Bacteriologie.—XL. Bd. 1905, Heft. 1. *C.f.*, Indican above. Indican is formed from Indol.

**Indoxyl.** $C_8H_5(NH)OH = 132{\cdot}1$ (133·066 I. Wts.).

Add an equal volume of hydrochloric acid. Shake and add a drop or two of sodium hypochlorite solution. Blue colour appearing indicates presence. May be shaken into a small quantity of chloroform to render more evident.

When Indican is found in the urine there is evidence of albuminous decomposition, and in cases of indigestion this is most frequently the result of putrefactive changes in the small intestine.—B.M.J. i./11,665.

## Nitrogen.

The quantity in Urine is approximately 0·9% as an average—(90% of this is in the form of urea).

Determination.—Heat 25 Cc. in porcelain basin with 10 Cc. of strong Sulphuric Acid until volume reduced to about 10 Cc. Finally, add about 5 Gm. of Potassium Sulphate to the residue in a flask in inclined position with small funnel in neck to act as condenser. Heat until colourless; cool and add very cautiously 20 Cc. water drop by drop, and introduce with utmost care a strong solution of Caustic Soda to alkalinity, for Kjeldahl method by distillation into a known quantity of Standard Acid and ultimate back-titration with alkali, or to near neutralisation by this modified method. Make up volume to 100 Cc.; take of this 10 Cc. = 2·5 Cc. of original urine, and treat this quantity with Hypobromite in a Doremus or other form of Urea Apparatus.

In this way 24 Cc. of moist Nitrogen = approx. 0·028 Gm. Nitrogen or
= 0·034 ,, Ammonia
= 0·06 ,, Urea.

When output of Nitrogen exceeds intake—tissue breakdown is in excess of re-construction. When active reconstruction is in progress the intake of nitrogen exceeds output in the urine and fæces. An even nitrogen balance may be maintained upon diets of a very different protein content, also upon a diet much poorer in protein than that usually taken by healthy men, but it does not follow that the reduced diet is an optimum diet—more probably we need habitually excessive quantities of food proteins to get from our diet all we need of each individual fraction of the protein molecules.—A. E. Garrod. B.M.J. i./11,1413.

See also Urea, p. **180**.

## Ammonia.

In urine may be estimated by distillation and Nesslerisation of the distillate or by aid of Volumetric Acid, as above.

The average amount of total ammonia in urine is 0·30% by weight.

Ammonia excretion varies during 24 hours—it is greatest during the night. Bodily exercise by producing acids increases output as also does consumption of fat (usually seen after interval of 1 to 2 days).

In fevers, malignant disease, diseases of the liver, ammonia is increased. In pernicious anæmia the amount may be considerably above or it may be rather below the average.

**Distillation** as a preliminary to estimation is best conducted *in vacuo* to prevent risk of decomposing the urea and thus causing error in result.—For details, *vide* Mann, p. 31.

**Schlösing's Method of Estimating** is simple, but according to Mann gives results rather too low. The specimen must be fresh. A bell glass is placed over a ground glass plate and the juncture rendered air-tight with a little grease. 10 Cc. of Decinormal Acid are placed in a shallow dish in the chamber and 20 Cc. of the specimen with an equal volume of milk of lime, supported above (as near as possible, *e.g.*, with a wire triangle). Allow to stand 48 hours, and estimate the free acid remaining—the combined acid indicating the amount of $NH_3$ liberated by the urine.

**Malfatti's Method**, using the formation of hexamethylene-tetramin from formaldehybe and ammonium salts, is favoured:—

Add to urine 25 Cc., in a 250 Cc. conical flask water 50 Cc., and 4 drops of alcoholic phenolphthalein solution 1%. N/10 sodium hydrate solution is added to neutralization which also gives the amount of acidity. 5 Cc. of 40% Formalin, neutral to phenolphthalein, is added and the titration continued until the pink colour reappears. From the number of Cc. used in the second titration the amount of nitrogen present as ammonia in the twenty hours' urine can be readily calculated. Better colour changes are stated to be obtained if 15 Gm. of potassium oxalate is added to the urine two minutes before titrating. The results obtained by this method are usually somewhat too high.—B. M.J. i./10,715.

It has been pointed out that there is a marked increase in the proportion of Ammonia to total Nitrogen—it may rise from the normal proportion 3 to 5%, up to even 45%, of the total Nitrogen—in women suffering from pernicious toxæmia. Vomiting of pregnancy indicates the existence of a serious toxæmia, which, if permitted to continue, will be found to be accompanied by lesions of the liver and other organs, inconsistent with life. A coefficient of 10% according to the author, is a danger signal.—L. ii./05,1172; B.M.J. i./07,316.

In the course of a case of diabetes, late in which disease the diurnal excretion of urea is usually increased, there is a drop in the quantity excreted and a corresponding rise in the ammonia salts, this is an evil omen—probably a warning of acid intoxication and therefore of coma.—L. i./07,784.

## Peptones. See Albumoses.

## Phosphates in Urine.

(Mean content is 0·15 to 0·2% $P_2O_5$.)

These are estimated by means of a **Standard Uranium Nitrate Solution**, prepared by dissolving 35 Gm. of the Nitrate in 900 Cc. of water, and standardising it against 50 Cc. of a solution of 5·012 Gm. of pure Sodium Phosphate (*Off.*) in 1 litre of water 5 Cc. of a solution of Sodium Acetate 100 Gm., with 100 Cc. of Acetic Acid in water *q.s.* to 1 litre is added, both in standardising and in the estimation of the sample of urine. A few small crystals of Potassium Ferrocyanide on a white tile serve as an indicator, the Uranium Nitrate Solution being added to the *hot* Standard Phosphate Solution (or the specimen) until a drop removed by the aid of a rod commences to cause a brownish precipitate with them. This amount of the Uranium Nitrate Solution corresponds to 0·05 Gm. $P_2O_5$. The solution may either be diluted so that 10 Cc. shall be equivalent to this quantity (1 Cc. of the Uranium Solution = 0·005 Gm. $P_2O_5$), or better, its strength may be noted and verified from time to time; 50 Cc. of the Urine is the quantity taken for examination, the conditions being the same as above.

Or the Phosphate Solution may be run into the Uranium—the end reaction being clearer, the disappearance of the brown colour is said to be more easily visible than its formation.—P.J. ii./04,9.

**Organically Combined Phosphorus** is in addition present in urine The daily average is stated to be 11 to 28 mgr. About $\frac{1}{3}$ of the total ingested Phosphorus is excreted by the bowels.

*Lime* taken in large amount, either apart or in food, causes the Phosphoric Acid in the urine to diminish—(Insoluble) Calcium Salts being excreted in the fæces.

The excretion of Phosphoric Acid is increased by the ingestion of small quantities of *Nucleinic Acid*. On a fixed diet for 2 periods of 8 days the $N : P_2O_5$ quotient, during one of the periods without Nucleinic Acid was 5·12 to 1, whilst in the other in which Nucleinic Acid was given, the proportion was 3·7 to 1. (The normal is about 5 or 6 to 1. $P_2O_5$ is not furnished by ordinary proteins but by tissues rich in nuclein). But administration of (Mineral) Metaphosphoric Acid did not give a $P_2O_5$ increase in the urine corresponding to the amount given.

In human milk the combined P is 41·5% of the total it contains; in cow's milk it is only 6%. N to $P_2O_5$ in the former is 3.3 to 1 and in the latter 2·3 to 1, yet the urine of the child at the breast gave ratio 7 : 1 whilst when fed by hand it was 1·7 : 1, *i.e*, organically combined phosphorus is retained. Organically combined phosphorus in the urine is probably derived from metabolism of the nuclein containing tissues and not influenced by ingestion of food rich in nuclein—feeding experiments confirm this.—Mann.

*q.v.* Also for causes of increase and decrease of Phosphoric Acid in the urine in disease.

## Purins.

Of the known Purin bodies, Xanthin, Hypoxanthin, Adenin, Guanin, Caffeine Theobromine, are met with in food, and Uric Acid, Xanthin, and traces of Methylxanthin are found in urine.

They all contain the grouping $C_5N_4$—Xanthin is dioxypurin, Uric Acid is trioxypurin. Uric Acid is in the largest proportion of the purins—about 10 to 1 of the others.

There is no special therapeutic effect in a purin-free diet.—B M J. ii./07,1759.

Purin in human fæces.—Walker Hall, B.M.J. ii./03,583; i./04,819.

A purinometer has been designed for estimating. Full directions are supplied with the apparatus.—L. i./03,899; ii./03,471; B.M.J. i./06,300.

Further directions for using the purinometer, with tables.—B.M.J. i./06,129.

Solutions for use:—

SOLUTION No. 1.—Ludwig's Magnesium Mixture 100 Cc., Ammonia (20%) 100 Cc., Talc, in fine powder 10 Gm.

SOLUTION No. 2.—Silver Nitrate 1 Gm., Ammonia Solution (strong) 100 Cc., Talc, in fine powder 5 Gm, Distilled Water 100 Cc.

(Both Solutions require vigorous shaking before use.)

Ludwig's Mixture consists of Magnesium Chloride (crystalline) 110 Gm., Ammonia Solution 250 Gm., Ammonium Chloride 110 Gm., Water 1 litre.

## Pus.

Leucocytes in excess are recognised microscopically—especially on addition of a little acetic acid—this brings into definition the nuclei and at the same times dissolves phosphate precipitates with which a deposit of pus is liable to be confused when the microscopic examination is not conducted.

## Sulphuric Acid.

**Total Sulphuric Acid.**—Dilute 50 Cc. of specimen with equal volume of water, add 10 Cc. HCl. Heat to nearly boiling, add Barium Chloride Solution in excess. Allow to stand on water bath for an hour or two. Collect wash and weigh.

$$\text{Ba SO}_4 = H_2SO_4.$$
$$233{\cdot}44 = 98{\cdot}086 \text{ (I. Wts.).}$$

**Ethereal Sulphates,** Estimation of —SALKOWSKI'S METHOD.

Add to 100 Cc. of specimen an equal volume of a solution composed of Saturated Barium Hydroxide Solution 2 and Saturated Barium Chloride Solution 1, allow to stand a short time, filter. Add HCl in strong excess to 100 Cc. of filtrate (representing 50 Cc. of the specimen). Heat to nearly 100° C. Collect precipitate thrown out and weigh. This gives the amount of ethereal sulphates. If substracted from the amount of total Sulphuric Acid, the proportion of Sulphuric Acid is obtained.

The Ethereal Sulphates normally found represent $\frac{1}{13}$ of the total sulphates Partially derived from tissues, the greater part are due to protein decomposition in the intestine — hence their increase in disease brought about by putrefaction and obstruction — or in foul empyemata or gangrene of internal organs.—Pharmacol, p. 56.

In health about $^1/_{10}$ of the Sulphuric Acid of the urine is in the form of *aromatic sulphates*—aromatic poisons taken with food or formed in the intestines are made to combine with the sulphuric acid which is formed in the system by oxidation of the cystin fraction of proteins. When the intake of or formation of aromatic poisons is excessive the proportion ($^1/_{10}$) is higher—in *carboluria e.g.*, nearly all the Sulphuric Acid is so combined.—B.M.J. i./11,1415.

## Urea in Urine, Estimation of.

Average 2.5 to 3%, or about (in health) 500 grains (33 Gm.) per diem ; it may range between 15 and 40 Gm. The majority of methods are based on the decomposition of Urea into nitrogen, carbon dioxide, and water when treated with sodium hypobromite. The carbon dioxide is absorbed by the excess of alkali present, and the nitrogen can be measured, from which, on reference to tables, the percentage can be found—theoretically 1 Cc. of nitrogen at 0° C. = 0.0027 Gm. approximately of Urea. In the process about 8% of the total nitrogen is suppressed, but the increase in volume of the gas due to the room temperature (taken as 18° C.) and the vapour tension (the gas being measured moist) has been found to almost exactly compensate for this loss in practice.

**Sodium Hypobromite Solution.**

Caustic Soda 100 Gm., Distilled Water 250 Cc. Dissolve, cool, and keep iced while adding *guttatim* Bromine 25 Cc.

Mix and dissolve. This solution is used to estimate the amount of urea in a given quantity of urine. On adding the solution, nitrogen is evolved from the urea and is measured in a **Doremus Tube**, in which each graduation represents 1 per cent. of urea in the urine, or by the ureometer of **Squibb's** pattern, the number of Cc. displaces an equivalent volume of water, and by tables this amount gives the equivalent.

(Sodium Hypochlorite Solution is also used but from a number of experiments which we conducted, we concluded the Hypobromite method is much to be preferred for Urea estimation).

It is better to keep the bromine separate ; it may be sealed in tubes containing 1,2,3, and 4 Cc. respectively ; 1 Cc. of bromine should be added to 11 Cc. of the solution as required. In place of these, **Liquor Bromi**—Bromine 1 Cc., Potassium Bromide 1.5 Gm., Distilled Water *q.s.* to 11 Cc. (= 1 in 11) may be used in equal quantity to the soda solution.

A little Glucose added to a urine increases the evolution by preventing a secondary reaction—formation of Cyanates and Nitrates—but, as indicated above, this is compensated for.—B.M.J. i./03,194,288, 341,403.

Patients treated with Urotropine pass urine which gives an orange precipitate with Bromine water. If due to Albumin, however, does not dissolve on warming.—L. ii./06,1459.

The **Doremus** form of Ureometer is graduated on the one side in decimal parts of a Gm., of Urea obtained from the 1 Cc. of Urine operated upon, and on the other, the figures 5, 10, 15, and intermediate ones indicate grains of Urea per fluid ounce.

With the **Victoria Ureometer** (an improvement on the old Doremus) no pipette is required, as the urine is added through a tap at the side.

Importance of estimating urea in disease. In renal disease maintenance of normal relation between intake and output of nitrogen is essential. This is far more important than testing for albumin. The gouty patient should have the urea estimated continuously to indicate progress of metabolism. The ordinary person lying in bed will on an average, unless there be some special interference with metabolism, pass urine containing a solution of urea of strength not less than 1.4%.—B.M.J. ii./08,1498; L. ii./08,1426.

If there is less urea to excrete the quantity of urine is lessened, not the strength of the solution.

*See also* Nitrogen p. **177**.

## Uric Acid in Urine, Estimation of.

Luff expressed the opinion that Uric Acid possesses no toxic properties whatever.—L. ii./05,1864.

$C_5H_4N_4O_3$ = 166.95 (168.072 I. Wts.), when pure is in white crystals, very slightly soluble in water, insoluble in alcohol and ether.

Heated to dryness on a water bath, with a little Nitric Acid or Potassium Chlorate and Hydrochloric Acid in a white dish, cooled, and a little Ammonia solution added gives a red colour.—The **Murexide Reaction.**

(Mean Content 0·05 to 0·06%) **Hopkins' Method.** To 100 Cc. of sample add about 30 Gm. Ammonium Chloride in powder, dissolve as completely as possible, or a small quantity may remain undissolved, add a little ammonia to neutralise and allow to stand 10 minutes. Filter off the precipitated Acid Ammonium Urate, wash with saturated Ammonium Sulphate solution* and rinse off the precipitate from the filter with water to 100 Cc. Add 20 Cc. Concentrated Sulphuric Acid to raise temperature of the liquid to about 60°C., or, if necessary, warm to that temp. Titrate with $^N/_{20}$ Potassium Permanganate (1·578 Gm. in 1 litre), taking as end-reaction the point at which the Permanganate ceases to be instantly decolorised. Each Cc. of the Permanganate Solution = 0·00375 Gm. Uric Acid.

The **Gowland-Hopkins' method** is as above to *, then proceed as follows:—Wash off the precipitate into a small beaker with a jet of hot water, add a little hydrochloric acid, and heat to just boiling. Allow to stand two hours in the cold. Collect the separated Uric Acid measuring the filtrate at the same time, for which an allowance of 1 mg. must be added on to the final result for every 15 Cc.: it need not exceed 20 to 30 Cc. Wash the uric acid crystals with a little distilled water, rinse off the filter with hot water, warm with sodium carbonate till dissolved and make up with water to 100 Cc. Add 20 Cc. Sulphuric Acid and titrate with Permanganate as above, adding slowly towards the end of the reaction, the finish being the first appearance of a pink colour which is permanent for an appreciable interval. Previously the disappearance of the colour is instantaneous.—P.J. i./99,266.

The acid Ammonium Urate may also be decomposed by means of Hypobromite.—L. ii./03,471.

**Uric Acid Outfits** are arranged containing Glass Tubes of Concentrated Permanganate Solution to produce extemporaneously 100 Cc. of $^N/_{20}$ Potassium Permanganate, and the other solutions and apparatus necessary for the entire estimation either by the Hopkins or the Gowland-Hopkins' method.

Other methods are (i.) Bartley's and the measurement of volume of Ammonium Urate in a graduated tube specially pointed; (ii.) a volumetric process, *i.e.*, Decomposition of the Ammonium Urate by a known quantity of Silver Nitrate and Titration of the Silver Nitrate, not converted into urate, quick and convenient; (iii) the acid Ammonium Urate is decomposed by Hypobromite and the nitrogen measured.—L. i./07,14.

A rough quantitative estimate can be obtained by heating the urine with Liq. Potassæ and a solution of Phospho-Tungstic Acid (5%) which gives a lilac colour. The intensity should be compared with that given by a Standard Solution of Uric Acid 1—1,000.

Bread may be a source of Uric Acid by setting free an excess of Phosphoric Acid (0·239 Gm. per 100 Gm. of new bread) an acid which does not find any base that can neutralise it—a case supporting this—Gautier's Opinion.—L. ii./07, 87.

The nitrogenous compounds in Urine, (i.) Uric Acid; (ii.) Creatinine; (iii.) Urea, may be fractionally precipitated by special reagents.—C.D. i./03,430.

## Acidity of Urine.

The **Acidity of Urine**, due mostly to the Sodium Acid Phosphate, is determined by titration with Decinormal Alkali using Phenolphthalein as indicator. Each Cc. of this standard solution = 0·012 Gm. of Sodium Acid Phosphate. Acidity is frequently reported in terms of the number of Cc. of this Alkali per 10 Cc. of Urine, *e.g.*, 3 Cc.=3°. The **Alkalinity** may be given in similar manner.

The urine of half-a-dozen individuals in health was found by us to have the following 'degrees' of acidity – 0·8°, 0·9°, 0·9°, 4·4°, 5·5°, 7·2°.

It was noticeable that this gradation did not correspond with the acidity as shown by delicate litmus paper—on the contrary, the two with 0·9° were distinctly different.

The acidity of the urine, according to Joulie, is dependent on the 'acidity' of the blood (due to acid phosphates). *C.f.* Sodium Sesquiphosphate.

**Sodium Bi-urate.** $C_5H_3NaN_4O_3 = 183·83$ (19·0064 I.Wts.) May be prepared by neutralising Uric Acid with Sodium Carbonate. Various opinions as to whether the crystals are the cause or effect of the inflammation in arthritis.—M.P. i./07,363.

A Portable **Urine Test Case** is arranged, containing the apparatus and reagents for the qualitative and approximate quantitative examination of urine for albumin, glucose and urea.—B.M.J. ii./99,1556; L. ii./99,1005.

A separate **Urea Apparatus** is also arranged.—C.D. ii./01,835.

## WATER ANALYSIS NOTES (*Chemical*).

Work in an atmosphere ammonia-free. The sample of Water should be received in a 'chemically clean' Winchester quart-stoppered bottle, and dated. Note **Physical Characters,** smell, sediment, and colour in a 3 feet tube.

**Total Solids** are ascertained by evaporating 100 Cc. in a platinum crucible on water-bath, the result being expressed in parts per million. The quantity being determined, it is essential that the amount of volatile and non-volatile matter should be determined, or, in other words, the amount of organic and inorganic solids, or those that will disappear on ignition and those that will not. Also notice the appearance on ignition, *i.e.*, charring (indicating organic matter), fuming, scintillation, &c.

**Oxygen absorbed.**—Warm ½ litre of the sample about 20 minutes in a flask with 1 Gm. $FeSO_4(NH_4)_2SO_4.6H_2O$ acidified with dilute Sulphuric Acid, then back-titrate with N/10 Potassium Permanganate.

**Free and Albuminoid Ammonia.**—Prepare some water, $NH_3$ free, by acidulating some good tap water with Sulphuric Acid, about 2 drops of a 1 in 3 solution to a litre of water and distilling. By so doing (the retort and condenser being chemically clean) even the first drop of distillate is Ammonia-free. Distillation may proceed, but must not be pushed too far. The distillate should be Nesslerised to verify its purity. Distil 500 Cc. of sample in a boiling flask with rubber cork to connect with condenser. Nesslerise each 50 Cc. of distillate with standard $NH_4Cl$ ,of which 1 Cc.=0.01 mg. $NH_3$ Add together the equivalent quantities of $NH_3$ and double the result to arrive at number of mgrs. of **Free Ammonia** per litre=parts per million. Stop distilling and add 50 Cc. of a solution of 0.4 Gm. Potassium Permanganate and 10 Gm. Potassium Hydrate which has been freshly boiled 20 minutes. Distil again and Nesslerise the **Albuminoid Ammonia** in 50 Cc. of the distillate at a time until it is $NH_3$ free. Add the equivalents together and double as above for parts per million.

Wanklyn divides waters in the following :—

*Class I. Of extraordinary purity, yielding from* 0.00 *to* 0.05 *part per million of Albuminoid Ammonia, which cannot be objected to organically. Class II. The general drinking waters of this country, containing* 0.05 *to* 0.10 *part Albuminoid Ammonia per million—this amount may be considered safe organically. Class III. Dirty waters, yielding more than* 0.10 *part of Albuminoid Ammonia per million.*

℗ **Nessler's Reagent** for **Ammonia** (*Off*).—*Syn.*

SOLUTION OF POTTASIO-MERCURIC IODIDE.

Dissolve Potassium Iodide 7 and Mercuric Chloride 2½, in Distilled Water 160. To this add more of the Mercuric Chloride in solution until the precipitate no longer disappears on well stirring, and a slight permanent precipitate remains. Then add Sodium Hydroxide 24, dissolve, add a little more solution of Mercuric Chloride and Distilled Water *q.s.* to 200.

On the addition of this test to ammonia or an ammonium salt in solution, it lets fall a brown precipitate of a basic Mercury-Ammonium Iodide ($HgINH_2 + HgO$)—Schmidt. Or the precipitate may be Dimercuric Ammonium Iodide $NHg_2I$ the equation being

$$2HgI_2+3KOH+NH_3=NHg_2I.H_2O+3KI+2H_2O.$$—P.J. i./II,88.

**Estimation of Ammonia in Water in presence of Hydrogen Sulphide.**

The presence of Hydrogen Sulphide in a water interferes with the Nessler test. If the amount of Ammonia be large the Sulphide may be precipitated with a Zinc or Lead Salt and the Ammonia can then be estimated directly by the Nessler Reagent. If the amount is small it is best to add to 500 Cc. the water, a measured quantity of N of Sulphuric Acid and distil 100 Cc.,—this completely removes $H_2S$. A volume of $N/_1$ NaOH equal to that of the $H_2SO_4$ used is now added. the water is again distilled until 200 Cc. have collected and the Nessler test is applied to the distillate.—J.C.S.A. ii./10,998.

**Chlorine.** Titrate 100 Cc. in a white basin with standard $AgNO_3$ of which 1 Cc.=1 mgr. of Chlorine, using potassium chromate as indicator. The reagents must be Cl-free and the water must not have an acid reaction. The average content is about 2 parts per 100.000, though frequently one finds a content of 5 to 15 parts per 100,000. It should be remembered that urine and sewage are, comparatively speaking, highly charged with chlorine—this enables the analyst to determine whether a high albuminoid Ammonia content is attributable to sewage or vegetable influence. *Per contra* almost entire absence of chlorides, coupled with excess of Albuminoid Ammonia, and little free Ammonia suggests vegetable contamination of a dangerous character. One frequently obtains waters for examination with an exceedingly high Cl-content in conjunction with an almost total absence of organic impurity.Such waters, though 'saline,' are suitable for drinking purposes.

**Nitrites.** To 100 Cc. of the sample add a weak, slightly acidulated, colourless solution of Meta-phenylenediamine. Nitrites give an amber to mahogany colour according to the amount. Conduct a control experiment.

[**Metaphenylene-diamine Hydrochloride.** *Syn.* **Lentine** $C_6H_4(NH_2)_2.HCl$. *Dose.*—$\frac{1}{6}$ grain once or several times daily. In acute diarrhoea Adult dose 1½ grain to 3 grains thrice daily. The urine becomes dark colored.—Gehe, see also Brickdale].

**Nitrates.** The test employed is to mix 1 part of saturated solution of a Brucine Salt with 3 parts of the specimen, and to "layer" beneath this carefully 1 part of pure Sulphuric Solution—a pink colouration indicates their presence,

**Total Hardness.**—To 100 Cc. of specimen add the least amount of soap solution (standardised so that 1 Cc.=1 mgrm. Calcium Carbonate or its equivalent) that will give a lather which will have an unbroken surface at the end of 5 minutes. 1 Cc. of the soap solution must be deducted from the amount required, as 100 Cc. of Distilled Water would require 1 Cc. to furnish a lather. The number of Cc. of soap solution required gives the number of mgrm. of Calcium Carbonate in the 100 Cc. of the specimen or the parts per 100,000.

**Standard Soap Solution** for the above determination:—Dissolve 10 Gm. of B.P. Hard Soap in 1 litre Alcohol 35%. 1 Cc. of this solution will contain soap approximately equivalent to 1 mgr. $CaCO_3$. To standardise to this equivalent dissolve 1 Gm. Powdered Marble or Calcium Carbonate in slight excess of Hydrochloric Acid, evaporate to dryness and redissolve in distilled Water, *q.s.* to 1 litre. Take, say, 12 Cc. of this solution, add Water to 100 Cc., and then Soap Solution, *q.s.*, to form lather as above. Adjust the Soap Solution until 13 Cc. are required. (100 Cc. of distilled water alone would consume approximately 1 Cc. of the Soap Solution in forming a lather.) We find London tap water varies between 15° and 17°.

**Poisonous Metals.**—Concentrate the water 5 times after acidulating with two drops of Hydrochloric Acid. Add Ammonium Sulphydrate solution. A darkening indicates Pb, Cu, or Fe, but not Zn. This darkened water should be divided into two parts. To one add Hydrochloric Acid—if darkness goes Fe is present. To the other portion add Potassium Cyanide Solution. If darkness goes now the metal is Cu; if it does not, it must be Pb. This latter proceeding is, of course, only necessary when the darkness does not go with Hydrochloric Acid. Confirmatory tests should always be employed. The confirmatory test for Fe and Cu is, to some original concentrated water in a test tube add Hydrochloric Acid and Potassium Ferrocyanide; a blue results with Fe, and a bronze with Cu. For Pb the Potassium Chromate test is employed. Zn gives a white precipitate with Ammonium Sulphydrate, and a white precipitate with Hydrochloric Acid and Potassium Ferrocyanide.

WELSH WATER.—A pure soft water acts upon zinc, *e.g.*, on galvanised kettles, in a solvent way, so as to become dangerous to health.—B.M.J. ii./05,1674.

EXCESSIVELY PURE WATER may be solvent of lead in service water. Recommendation to harden it by adding lime.—L. ii./08,1183.

PEATY WATERS owing to *acidity* often dissolve lead from main pipes in the form of lead hydrogen carbonate. On standing or on boiling, it is thrown out with the calcium carbonate. Methods of detection and estimation.—P.J. ii./09 663.

LONDON WATER.—Houston.—B.M.J. ii./09,85. See also this work p. **265**.

CHALKY WATER.—On the influence of calcareous waters in health and disease. Public (and often other) opinion is to the effect that chalky drinking waters may be responsible for a variety of complaints, *e.g.* gout, rheumatism, calculus, constipation, biliousness, dyspepsia, eczema, goitre and arteriosclerosis. For a very useful discussion of this subject see P.G. Lewis. B.M.J. ii./11,158. The author sums up: "There is no evidence that hard water has any bad effect—on the contrary, the evidence is all the other way."

In interpreting Water Analysis Reports the bacterial data must go hand-in-hand with the Chemical. In the bacterial the report depends on the type of bacteria found—the presence of non-pathogenic organisms not necessarily condemning the water.

Before a final judgment can be delivered upon any water there have to be taken into consideration (1) its geological history, (2) the rainfall before and after collection, (3) the method of storage and distribution, (4) the surface drainage, and (5) a bacterial analysis. A water which chemically is organically pure may be bacterially contaminated, and on the other hand a bacterially pure water may be chemically dangerous or suspicious.—Purvis, P.J. ii./10,149.

## MILK ANALYSIS.

### Average Chemical Composition:—

**Water** approx.=87·44%. **Milk fat** approx. = 3·81%; **Non-fatty solids,** 8·75; including the following, **Lactose** (average 4%); **Proteids** (Casein average

3·5%); **Mineral matter.** Milk also contains small quantities of Citric Acid and an Enzyme.

The following data are necessary to determine quality of a specimen :—

(1) **The Specific Gravity** may be determined by a Specific Gravity bottle or Lactometer; the average reading is 1·031.

N.B.—Low gravity may indicate added water, or in some instances riches in fat.

(2) **To Determine Total Solids.** Evaporate 5 Gm. of the specimen on a water bath in a tared platinum capsule; the residue, which should be nearly white, averages 12·8%. Board of Agriculture requires at least 11·5%.

(3) **Fat.** Two determinations at least should be conducted, particularly if the figure for the non-fatty Solids is to be taken as the difference between the Fat result and that of the Total Solids. The **Werner-Schmidt method** is as simple and convenient as any :—

Shake the milk and place 10 Cc. of same in a Schmidt tube (graduated to 50 Cc.) and provided with a cork. Add 10 Cc. Hydrochloric Acid. Heat corked 10 minutes on water-bath, shaking occasionally: then cool rapidly under water stream, when quite cold fill the tube to 50 Cc., mark with ether (pure). Insert cork and shake vigorously 1 minute, allow to separate and read off the volume of ether. Remove 2 separate 10 Cc. and evaporate in tared dishes. Take the mean and calculate % of fat. *It must not be less than 3% vide infra.*

(With regard to this 3% Milk Fat Standard it is known that the yield from the same cow may vary greatly, *e.g.*, it may be 2½% in the morning and as high as 4½% in the afternoon. The milking should be done at equal 12 hours intervals as far as possible.)

**Cream** in normal milk is about 10% varying with season, pasture, etc.

Milk that has been adulterated with water throws up its cream readily. **Refrigeration of Milk** prevents cream rising, Milk that has been **Pasteurized** will not throw up its cream at all.

**Non-fatty Solids** can be determined :—

By subtracting the fat content from the Total Solids. *Must not be less than* 8·5%.

**Lactose, or Milk Sugar Estimation** (Average content 4%).

Dilute 50 Cc. of sample with water 150 Cc., add a few drops of Acetic Acid to throw out Casein and Albumin, boil for a short time and after cooling make up to 250 Cc., finally allow to stand and filter. 5 Cc. of the filtrate represent 1 Cc. of the original milk. Into 5 test tubes marked '1' to '5' place 5 Cc., of freshly mixed Fehling Solution; dilute with an equal volume of water and add from a burette to No. '1' 3 Cc., to No. '2' 3·5 Cc., to No. '3' 4 Cc., to No. '4' 4·5 Cc., to No. '5' 5 Cc. of the above filtrate, place on a sand bath and boil for six minutes. According to the colour of the supernatant fluid in the tubes one notes whether the reduction is complete. It may be necessary to repeat the test, using intermediate quantities, *e.g.*, 4·1, 4·3, &c., Cc. of the filtrate. The calculation is on the following lines :—

In an experiment 4·15 Cc. of the filtrate were necessary 1 Cc. of Fehling Solution $=0{\cdot}00675$ Gm. Lactose ∴ 4·15 Cc. Filtrate $=0{\cdot}03375$ Gm. Lactose, *i.e.*, $\frac{4{\cdot}15}{5}$ Cc. Milk $=0{\cdot}03375$ Gm. Lactose ∴ 100 Cc. Milk $=\frac{0{\cdot}03375\times5\times100}{4{\cdot}15}=4{\cdot}07$ Gm Lactose.

**Lactose Determination by Polarimeter :—**

Add to 60 Cc. of the Milk 10 Cc. of a solution of Mercury in twice its weight of Nitric Acid 1·43 diluted with four times its volume of water. Make volume up to 102·4 Cc., filter. Note rotation in 200 m.m. tube,—divide by 2 and by 53 the specific rotation for lactose. Result is the amount of lactose per Cc. in the solution. Multiply by 100 to give the amount in 60 Cc.—P.J. ii./04,850.

**Mineral Matter** of Milk can be obtained by igniting the milk solids, and usually averages 8·3% of them.

*N.B.—A dilution of normal milk with water will reduce the ash almost proportionately to quantity of water added, so the combination of a low ash and low non-fatty solids would point strongly to addition of water.*

**Casein Estimation** (Average content 3·5%.).—Dilute 20 Cc. of the sample with 300 Cc. water, and add strong acetic acid drop by drop to complete precipitation. Pass in carbon dioxide for 20 minutes, collect the casein and fat on a weighed filter paper; wash thoroughly with, firstly, alcohol, then ether to remove fat (well conducted in a Soxhlet thimble on water bath), dry and weigh.

For method of estimating proteids by Kjeldahl's process, see P.J. ii./04,851.

Many proteins are precipitated by Acetone, Weyl applied this property to estimation of the Proteins in cow's milk and in fresh bullock's blood and obtained concordant results. The milk or blood is diluted with equal volume of water and poured into four volumes of Acetone. The precipitate is collected, washed with equal volumes of Acetone and Water then with Alcohol and is finally extracted with Ether in a Soxhlet apparatus, dried and weighed --J.C.S.A. i./10,287.

**Milk, Cream and Butter Preservatives.**—The most commonly occurring are:—Salt, Sodium Bicarbonate, Boric Acid, Formalin, Hydrogen Peroxide, and Glycerin.

**The Board of Agriculture** in 1901 issued certain '**Sale of Milk Regulations**' which require a minimum of 3% milk fat, also at least 8·5% milk solids other than fat. Skimmed or separated milk to have at least 9% milk solids.

Taking advantage of the exceedingly low standards laid down by the Board of Agriculture it appears that farmers are making an additional profit by toning down milk with skimmed or separated milk so as to keep the fat content just within the standard. Suggestion that this should be overcome by revision of the Regulations.—B.M.J. ii./10,1178.

Mr. J. Burns introduced a Pure Milk Bill in the House of Commons in May, 1909, which, owing to pressure of business was dropped for a time; ultimately (April 1910) legislation was refused on the matter. So far as London is concerned the County Council will apparently be taking some much needed steps. The Bill was intended to summarise orders by the Local Government Board, powers of Sanitary Authorities, Enactments by Borough Councils, etc. For provisions of the Bill see P.J. Supp. i./09,368; Leader on, B.M.J. i./09,1378; See also B.M.J. i./09,1451 (Provisions for Scotland).

The Bill may be revised in view of the final report of the Royal Commission on Tuberculosis.

For the legal requirements as to Butter, Cream, etc., "The Law and Chemistry of Foods and Drugs," Robinson and Cribb, (Rebman) may be consulted. Though the Local Government Board Committee, a few years ago recommended that no preservatives should be used in Milk, but that **Boric Acid** (Boron Preservatives) 0·25%, might be used in **Cream** and 0·5% in Butter, Parliament has never yet legalised these recommendations. The position, therefore, is governed by the **Sale of Food and Drugs Act, 1875-1899,** but there is nothing in the Act dealing with the *exact quantities* of preservatives.—*vide infra.*

It would appear from the Act *that any food may be sold providing no false description be given, that the article is in accordance with purchaser's demand, and that no substance be incorporated so as to render the article injurious to health.*

The following are amongst the offences: Section 3 of the 1875 Act: To mix, color, stain, or powder any article of food with any ingredient or material so as to render the article *injurious to health.* Section 6, to sell any food or drug not of *the nature, substance and quality demanded.* (*No offence is committed* if the added matter is not injurious to health, but is required for its production or preparation as an article of commerce, in a state fit for carriage or consumption, etc.).

'Sale of Food and Drugs Act' 1899 (62 & 63 Vict. ch. 51):—

Section 1 virtually enacts that if there is imported into the United Kingdom any of the following articles, Margarine, Margarine-cheese, Butter-milk, Cream, Condensed, Separated or Skimmed milk, or any article of food adulterated or impoverished the importer shall be liable, unless the same articles be imported in packages or receptacles conspicuously marked with a name or description indicating that the article has been so treated.

Further Sections deal with the method of marking packages. An article of food shall be deemed to be adulterated or impoverished if it has been mixed with any other substance, or if any part of it has been abstracted so as, in either case, to affect injuriously its quality, substance or nature, but an article of food shall not be deemed to be adulterated by reason only of the addition of *any preservative* or coloring matter of such nature and in such quantity as not to render the article injurious to health.

The Departmental Committee's Blue Book issued in 1901 and Dr. Hamill's recent report on Preservatives in Cream should be consulted.

Hamill states (C.D. ii./09,473) that "Thickeners" such as *gelatin, starch-paste* and *sucrate of lime* have been used for cream. Mixtures of *Boric Acid* and *Borax* mixed in such proportion so as to be neutral, have been used as preservatives. *Saccharin* is used to mask incipient sourness. *Sodium Salicylate* and *Benzoate* are also used in the hope of their being overlooked after the Boric Acid (which is allowed to the extent of 0.25%) has been detected. *Formalin* is unsuitable, *Sodium Fluoride* is used and is thought dangerous, *Hydrogen Peroxide* is also employed—100 Cc. of 3% to each gallon maintained at 120° F. in a closed vessel for 1½ hours, then 1 or 2 drops of 'Catalase' added to decompose excess of Peroxide. Dealers in 'Jug Cream' think the Boric Acid permitted is insufficient.

According to recent work in U.S.A. Sodium Benzoate should be the least harmful of all.

**Milk Preservatives.** **Public Health (Milk and Cream) Regulations 1912.** The Local Government Board drafted regulations under the Public Health Acts coming into force June 1st, 1912, which will apply to the whole of England and Wales, ***prohibiting the use of preservatives in milk.*** They provide that "*no person shall add, or order or permit any other person to add, any preservative substance to milk intended for sale for human consumption, and that no person shall sell or expose or offer for sale, or have in his posession for the purpose of sale, any milk to which any preservative substance has been added.*" Cream Preservatives—The regulations further provide that no person shall add, or order or permit any other person to add or sell—(a) *any thickening substance to cream or preserved cream*; (b) *any preservative substance to cream containing less than 40% by weight of milk fat*; (c) *to cream containing 40% or more by weight of milk fat any preservative substance other than* (1) *boric acid, borax, or a mixture of those preservative substances*; (2) *hydrogen peroxide, in amount not exceeding* 0.1% *by weight*, in cream intended for human consumption.—*c.f.* L. i./12,592.

Any person selling preserved milk or cream contrary to these regulations will be liable to conviction under the Sale of Foods and Drugs Acts.—P.J.i./12,283.

'**Mystin**' a preservative used for milk, cream, etc., on analysis was shewn to consist of Sodium Nitrite 9.85%, Formaldehyde 0.30% in Water. Dr. Monier Williams calculates that a quart of milk treated with the preservative in the proportion directed would contain 2 grains of Sodium Nitrite (*i.e.*, the maximum pharmacopœial dose). The presence of the Nitrite "masks" the detection of presence of Formaldehyde in the milk. After heating the acidified milk with a little Urea the presence of Formaldehyde can then be easily detected or distillation with Phosphoric Acid will set free the Formaldehyde.

'**Accoine**' was found to contain Sodium Benzoate 13.97% and Sodium Carbonate 1.94%. A preservative for Margarine was found to consist of Sodium Fluoride. In detecting the presence of Fluorides the value of the Titanium Test is pointed out, which depends upon the bleaching action of Fluoride Compounds upon a Peroxidised Titanium Solution.—the orange-yellow color of which is partially discharged in presence of Fluorine Compounds.—B.M.J. i./12,384,512, L.i./12,446. P.J.i./12,395.

It is held that *preservatives may prevent milk from tasting sour*, whilst at the same time *not inhibiting the growth of many kinds of disease germs.* According to the new order of things, 'sweet' milk purchased in the hot weather will be in reality fresh, and being fresh the chances that it is contaminated with disease bacteria will be greatly reduced.

The "British Food Journal" provides weekly reports on prosecutions, and reports relating to the question of preservatives in foods.

**Detection of Boric Acid in Milk** (*will preserve,* 1 *in* 500).

This, the most frequently employed preservative is detected by evaporating and incinerating at least 10 Gm. of the milk. Acidify the ash slightly with dilute hydrochloric acid (using Litmus). A strip of turmeric paper is now placed in the capsule, so as to be only partly wetted by the liquid. Evaporate to dryness at 100° C.

If boron compounds are present, the part immersed in the liquid will turn brownish-red (formation of rosocyanin). On moistening with a drop of caustic soda, green and purple colours will be produced. On re-acidifying with hydrochloric acid, the red colour is restored, and is again changed to green and blue with excess of alkali.

The flame test is well-known. Evaporate to dryness, treat the ash with a few drops of strong sulphuric acid, add a little methyl alcohol, and apply a light. The alcohol will burn with green at the edges of the flame (at the moment of ignition more particularly).—Allen, Vol. 4, pp. 175 *et seq.* A further test —B.M.J. i./09,1216.

Toxic Symptoms.—Gas in the stomach and intestines, colic, pain in the epigastrium and diarrhœa may be caused by excessive consumption of Boric Acid

Possible cause of increase of appendicitis.— Campbell Williams.

A content of 21.91 grains per lb. of cream considered injurious to children and invalids. Appeal case, Cullen *v.* McNair.—L. i./08,124.

**Detection of Formalin in Milk.**

A teaspoonful will preserve 10 gallons of Milk for 3 days in hot weather.—Pharm. Form.

A large addition can be detected by simply warming ; but it is better to distil the milk ; the distillate has the odour of formaldehyde, but the preservative is not wholly volatilised even when evaporated to dryness at 100° C. In employing colour tests for formaldehyde a notably weaker reaction is obtained when milk containing formalin is distilled and the distillate tested than when water containing the same proportion of formalin is similarly treated.

O. Hehner has determined the rate of disappearance of formalin when added to milk. He found that after one week no formalin could be detected in a sample which originally contained 1 part of formalin in 100,000 parts of milk ; after two weeks none could be found in the 1 : 50,000 sample ; while after three weeks there was only the faintest trace to be detected in the 1 : 25,000 sample. The experiments were made in cool weather, and the formaldehyde was tested for by Schiff's reagent in the distillate from the milk, see also Hehner's Test, *infra.*

**Schiff's Reagent.**—Mix 40 Cc. of a 0·5% solution of magenta with 250 Cc. of water, add 10 Cc. of sodium bisulphite solution Sp. Gr. 1,375, and then 10 Cc. of pure strong sulphuric acid ; allow to stand for some time, when it will become colourless. It may also be prepared when required for use by adding sufficient of a solution of sulphurous acid to decolorise some of the magenta solution. If the sulphurous acid is added in large excess, traces of formaldehyde will not be indicated. Reddish violet colour proves presence of formalin. *Other aldehydes, including aromatic aldehydes, also give this ;* but these would hardly be suspected.

*The colour is given with milk which certainly had no formalin added,—due to the presence of a fixed aldehyde. It is better to distil as above mentioned or to use* **Hehner's Test,** *i.e. purplish violet ring on layering milk on to strong sulphuric, acid ; vide also M. Reagent. Verzeich., p.* 60. *It is, however, a group reagent for various aldehyde bodies.—Am. Jl. Ph. Aug.*/09,394.

The presence of Formalin 1 part in 200,000 can be detected with this Test also by the following modification :—

If to the distillate from a sample of milk one drop of a dilute aqueous solution of Phenol is added and the mixture poured upon some strong Sulphuric Acid in a test tube, a bright crimson ring appears.

**Phloroglucin Test.**—To 5 or 10 Cc. of the milk add 5 drops of 1% aqueous phloroglucin solution; shake and add 5 drops Liquor Sodæ 30%. Salmon colour (not yellowish tint) indicates addition of formalin. *We found recently that this test will show* 1 *of Formaldehyde* (*actual*) *in* 50,000 *of milk.*

**Rimini's Test.**—A satisfactory confirmatory test, being almost specific for Formaldehyde. For method of applying see 'Formaldehyde in urine' p.**170** *We found recently this test will show* 1 *of Formaldehyde* (*actual*) *in* 100,000 *of milk.*

Added to foods tends to derange metabolism. Wiley in United States investigated the effect of doses of 100–200 millegrams of Formaldehyde (given with milk) on 12 men during 15 days, the total being 2.5 Gm. to each man. Burning in throat, itching rash, retardation of Nitrogen and Sulphur metabolism, acceleration of phosphorus metabolism, and loss in bodyweight were observed. Apart from harmfulness as a milk preservative, its use is inadvisable, as in dilute solution it prevents the growth of acid-forming bacteria, while not retarding many harmful organisms.—L. i./09,411.

The general public and members of the profession do not realise the extent of which milk butter, and preserved meats are drugged with Boric Acid and other preservatives.—Pr. Feb. '09,268.

As regards the detection of Formaldehyde in pharmaceutical preparations, etc., the Gallic Sulphuric Acid test used by mixing, (not as a ring test) and raising temperature. to 100°C for 10 minutes is stated to detect as little as 1 in 800,000. If stronger than 1 in 2,000 a green color is obtained instead of the intense blue.—Evans, Anal. Notes, 1911.

Various forms of apparatus are in the market for detecting adulteration of milk, *e.g.*, The **Lacometer Cream Tube** and **Lactoscope**—the last mentioned detects by the optical properties of milk its adulteration with water—or removal of cream. The **Cream** in 'Pure Milk' should be about 10%—it is frequently considerably more and varies with season, pasture, etc. (*c.f. antea*)

**Bacteriological Standards** for milk.—B.M.J. i./06,452. For *B. tuberculosis* in milk, *v.* p. **250**

**Condensed Milk** should have a minimum of 32% of total milk solids with 10% of fatty solids.

"THE NATIONAL LEAGUE FOR PHYSICAL EDUCATON AND IMPROVEMENT" issues leaflets to instil into the minds of all concerned in production and consumption of Milk simple rules required to ensure purity and cleanliness of milk —L. i./11,123.

## BUTTER ANALYSIS.

**Average Chemical Composition of Unadulterated Butters:**

Water 6·5 to 11·2, Curd 2·4 to 3·1, Salt 1·6 to 2·0, Fat 83·7 to 89·5%.

The following data are necessary to determine quality of a specimen.

(i). **Estimation of Water**:—Heat 5 Gm. in an air-oven to 110° C. The loss should not exceed 17%, if more suspect careless making or intentional adulteration.

(ii). **Estimation of Curd and Salt**:—Melt the residue of (i) and treat with 10 Cc. ether, filter through tared filter, repeat the process and wash until all ether-soluble matter is removed, dry residue and weigh; the residue consists of curd and salt.

(iii). **Estimation of Ash**:—Ignite residue from (ii) and weigh. Should be wholly salt; confirm this by standard Silver Nitrate solution.

(iv). **Estimation of Fat**:—Should be taken by difference by subtracting the sum of percentages of water, curd and salt from 100.

(v). **Detection of Foreign Fats**:—Prepare some butter-fat by melting 8 Gm., pour off and filter through dry filter, being careful not to pour any of the water on to same. Saponify on a water-bath 5 Gm. of the clarified fat in a tared flask, capacity about 250 Cc. marked at 150 Cc.; add 50 Cc. Alcoholic Solution of Potash (3%) and distil off the alcohol. Dissolve the residual soap in a little hot water, add 25 Cc. Sulphuric Acid (5%) and make up with distilled water to 150 Cc. add a little pumice and capillary glass tubes and distil off 100 Cc. filter same and titrate with $N/_{10}$NaOH (using Phenolphthalein). 5 Gm. pure butter-fat should require not less than 25 Cc. of alkali; lard, tallow, beef-fat, &c., require only about 1·5 Cc., cocoanut fat would require about 7 Cc.

**Exception.**

In the winter some butters require only about 21 Cc. of alkali, the sample should therefore not be condemned unless it requires less than the minimum amount.

In 15 samples of **Margarine** vegetable oils to the extent of 40 to 90% of the total fat were found—in most cases it was Cocoanut Oil. The food value of all animal and vegetable fat is the same—both yield 9·1 Calories of energy per Gm.—B.M.J. ii./11,959,1336.

## Anillin Dyes used in Colouring Foods.

**Egg Yellow.**—*Syn.* **Acid Yellow.**

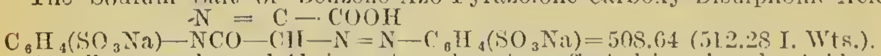
The Sodium Salt of Amido-Azo-Benzene-di-Sulphonic Acid. Some Mono Sulphonate is usually also present

$SO_3Na(4)C_6H_4—N:N—C_6H_3SO_3Na(3)\ NH_2(4) = 398.42$ (401.242 I. Wts.).

A reddish-yellow powder *soluble* in water—aqueous solution has a neutral action, mineral acids change the colour to a bright red, yellow being restored by the addition of alkali. Used for colouring milk (1 in 200,000), Egg Powders—Custard prepared for table contains about 1 in 40,000.

**Lemon Yellow.**—*Syn.* **Tartrazine.**

The Sodium Salt of Benzene-Azo-Pyrazolone-Carboxy-Disulphonic Acid



$$C_6H_4(SO_3Na)—\overset{N\ =\ C\ —\ COOH}{NCO—CH}—N=N—C_6H_4(SO_3Na) = 508.64$$ (512.28 I. Wts.).

A yellow powder, *soluble* in water, almost unaffected in colour by Acids or Alkalies. When Tartrazine is reduced Sulphanilic Acid is formed. Used for colouring lemonade and similar beverages, a common proportion being 1 in 500,000.

**Annatto Substitute.**

Is a mixture of Acid Brown No. 1 (10 parts) and Acid Yellow (8 parts). *Acid Brown* is the Sodium Salt of Para-Sulpho-Benzene-Azo-Metatoluylene-Diamine (4) $(SO_3Na)C_6H_4N:NC_6H_2(CH_3)\ (NH_2)_2$(1.5.2.4.).

A dark brown powder with occasional yellow specks dissolving easily in water. The solution has a neutral reaction and is of a dark red colour, becoming yellow when greatly diluted. Mineral Acids change the solution to a bright red. Alkalies return original colour.

Used for the same purposes as the vegetable colour (has approximately 25 times the tinctorial power of the commercial extracts of the fruit, of which 1 tablespoonful is added to 30 lbs. cheese, *i.e.*, 1 part in 960) for tinting Milk, Butter, Cheese (1 in 24,000), Haddocks, etc.

**Annatto Extract.**—Bixin related to *m*-xylene is the essential colouring matter. The Extract is usually strongly alkaline.

General conclusions of the investigation appear to indicate that in the amount used Egg Yellow, Lemon Yellow, and Annatto Substitute are harmless.—S. Rideal, L. i./11,1597,1656.

## CARBON MONOXIDE AND DIOXIDE TESTS.

Frequent deaths have recently occurred from Carbon Monoxide poisoning Ordinary Coal Gas and Carbon Dioxide are also sources of danger.

Water Gas and Producer Gas are used for motive power of engines and for heating purposes, whereas for general lighting Carburetted Gas alone or Carburetted Water Gas mixed with Coal Gas is used.

Producer Gas is made by passing air or a mixture of air and Steam through Incandescent Coke or Anthracite Coal in a furnace generator, as in the Dowson producer. Consists of Hydrogen, Nitrogen, Marsh Gas, and CO with $CO_2$ as its principal impurity.

Water Gas is made similarly, except that steam only is passed through the Coke, and the product being chiefly Carbon Monoxide and Hydrogen. $C + H_2O = CO + H_2$.

Carburetted Gas differs from both the above. It is made by passing Water Gas made as above over heated refractory material charged with oils rich in hydrocarbons. The volatilised benzene and benzene congeners mix with the Water Gas.

| | | |
|---|---|---|
| Coal Gas contains ... ... ... ... ... ... | 6—9% | CO. |
| Producer or Water Gas ... ... ... ... ... | 25—50% | ,, |
| Carburetted Gas ... ... ... ... ... ... ... | 30% | ,, |

—L. ii./06,1578,1649 (including treatment).

The following test will indicate one part of Carbon Monoxide in 10,000 parts of atmospheric air. Even ¼ to ½% of the gas is most injurious, and if inhaled for some time may be fatal (Schmidt).

10 to 20 litres of air are aspirated for about 15 or 20 minutes through 10 Cc. blood (fresh) diluted, 1 to 10 with water. The blood is then heated to the boiling point in a flask, and a current of air is passed into it which has previously passed through a solution of Palladium Chloride.* The air, which passes out of the blood, is then led into bottles containing Lead Acetate Solution, diluted Sulphuric Acid, and another quantity of diluted Palladium Chloride Solution, in this order.

The presence of Carbon Monoxide in the air under examination is proved by the deposition of reduced Palladium metal in the last mentioned Palladium Chloride solution. A quantitative method on this principle is based on the fact that 106 parts of Palladium deposited are equal to 28 parts of Carbon Monoxide.

Note.—The blood used for the absorption of the Carbon Monoxide, is to be heated immediately after the aspiration with the air under examination and the passing of the air is to be continued three or four hours.

The gas may also be detected by the aid of the spectroscope.

Death from Carbon Monoxide due to imperfect stove.—L. i./03,258. Due to fire.—L. ii./05.1894. Carbon Monoxide is by some considered the cause of the injurious effects of tobacco smoking.—L. i./04,394.

Three cases of Carbon Monoxide poisoning,—two due to imperfect combustion in a gas stove which was unprovided with a flue. The blood of one of the victims was found to be saturated to the extent of 60% with the gas. In these two cases the victims had apparently not become aware that the stove had 'struck back.' In the third case, in which 76% was found in the blood, death was due to the fusing of an iron gas pipe by an electric wire.—L.ii./10,879.

Carbon Monoxide Poisoning in the Whitehaven Colliery Disaster. It was thought that 85 of the 136 victims met their death from CO,—in 35 this was definitely proved. CO—hæmoglobin was detected five months after the disaster.—L. ii./10,1693.

Estimation of Carbon Monoxide.—P.J. ii./11,787.

## Detection of Carbon Monoxide in the Blood.

In addition to the spectroscopic method, **Kimkel's Colour Test** is valuable. Necessary are a pipette, 2 small test tubes, and a 3% Tannin Solution.—For details of method see Dix and Mann's Forensic Medicine.—B.M.J. i./05,1382.

Increase of Carbonic Oxide in illuminating gas.—L. i./04,1427.

**Carbon Dioxide.**—Haldane's apparatus is used for estimation in the air.

**Nickel Carbonyl.** causing degeneration of certain parts of the nervous system, produced three deaths.—L. i./03,269,1842. Latest examination of the compound and effects of. Iron Carbonyl is less toxic.—L. ii./07,907. Symptomatic treatment and purgation cured a case of nickel poisoning in a metal worker caused by nickel dust being absorbed.—L. i./08,40.

The poisonous symptoms are occasioned by the absorption of the nickel set free. Nickel Carbonyl poisoning is a particular case of nickel poisoning. The nickel is deposited over the immense surface of the lungs in a condition especially favourable for its absorption.—L i./09,487. Probably as a hydrated sub-carbonate —B.M.J. i./09,52.

***Antidote.***—Oxygen.

For treatment of persons who have inhaled these noxious gases, fresh air, sulphur baths, good food with Quinine and Nux Vomica, Chloroform Liniment with friction for local neuralgia and commencing neuritis.—L. i./03,337 ; ii./03,117.

Chlorine inhalation and taken internally employed. Early and judicious use of this (by action of Hydrochloric Acid on Potassium Chlorate) should be successful. Oxygen was unavailable in this instance (a case of coal gas poisoning from a gas bracket).—L. i./07,1155.

Interesting Experiments at the London Hospital (June 1910), on 6 students showed that Carbon Dioxide (4%) is not poisonous but injurious effects due to stagnant condition of the air and moisture,—*Fanning* the air caused resuscitation.

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*Palladium Chloride in 3% aqueous solution. *Dose.*—5 to 10 minims before meals. Has been advocated for use in treatment of tuberculosis of the lungs. Said to improve appetite, and diminish the fever and coughing. Contra-indicated in nervous and neurasthenic patients.

## PTOMAINES.

Under this name are classed a number of basic substances which are produced in meat, fish, and albuminoid food undergoing putrefaction by decomposition or by bacterial metabolism. They are akin to the alkaloids, several being dangerous poisons. Hence the occasional outbreaks of ptomaine poisoning from the consumption of meat pies, fish, and the like.

*Symptoms* are those of gastro-intestinal irritants, but they may resemble those of Atropine poisoning. Dryness of the tongue, thirst, dilated pupils, debility, with probably rigors, offensive diarrhœa, high temperature, sickness with convulsions.

**Tyrotoxicon** occurs in stale cream, cheese, milk products ; causes vomiting, purging, rapid pulse, dyspnœa, depressed temperature and prostration.

***Antidotes.***—Give emetics and Castor Oil, then stimulants. Amyl Nitrite, Strychnine, Digitalis, Caffeine, Sal Volatile, Tannic Acid, and Atropine hypodermically.

For **Fish Poisoning** give Potassium Chlorate or Liquor Ammoniæ Acetatis also Tinctura Capsici and Spiritus Chloroformi.

Presumed Ptomaine poisoning from tinned fish.—L. ii./03,755,848.

Poisoning by bad bacon treated with Calomel, and later injections of Atropine and Strychnine.—B.M.J. i./06,258.

Outbreak of illness due to tinned meat in Carlisle. The meat (American Corned Beef) reported as bacteriologically unfit for food. It was proved to be contaminated previous to, or at the time of, canning in America.—L. ii./10,1613.

## II.—EXAMINATION OF STOMACH CONTENTS.

An **Outfit** is arranged containing the necessary **Reagents** and **Apparatus** The **Reagents** include Blue Litmus * Paper, Congo Red (an anilin colour turned blue by acids and red by alkali, the reverse of Litmus, indicates absence of Hydrochloric Acid in the stomach in cases of cancer, as weak Lactic Acid does not interfere), Benzopurpurin Paper, Alizarin Solution, Dimethyl-amido-azo-benzol Paper and Solution (an acid and alkali indicator which is not affected by Carbon Dioxide—a 1 in 500 Alcoholic Solution of the compound is used in ordinary chemical testing), Decinormal Soda Solution, Ether, Caustic Potash Solution, Phenolphthalein Solution (*Off.* 1 in Alcohol 90%, 300 with Distilled Water to 500, is reddened by alkali, but is not suitable for ammonia estimation), Cupric Sulphate Solution, Lugol's Solution, Methyl Green and Methyl Violet and other Test Solutions.

The **Stomach Tube** should have bevel-edged eyes, known as "velvet eye." Van Valsah's tube is recommended by Herschell.† In this the smaller eye of the two should be on a level with and opposite the upper border of the other ; this arrangement prevents possible blocking of the tube and injuring the lining of the stomach.

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* LITMUS is a blue pigment from *Roccella tinctoria* (*Discomycetes*). LITMUS SOLUTION (B. P. Appendix).—Boil litmus 2 with alcohol 90% 8 for 1 hour, pour off clear liquid, repeat with 6 and again with 6. Digest the litmus thus washed in distilled water 20, and filter.

For titration of alkaloids, etc., with this and other indicators, *v.* Allen, vol. ii, part 3, '07,137, *et seq.*

All $CO_2$ must be removed by boiling before taking end reaction. Not suitable for weak bases. Quinine, Morphine and Strychnine are neutral to it and the acids in their salts can be titrated as if base were absent.—P.J.ii./08,194.

Carbon Dioxide only turns Litmus "wine red" when alkaline bicarbonates are present as impurities, otherwise it turns it red just like any other acid.—Na. Aug. 1911, p. 215.

**Kubel and Tiemann's Litmus Solution** a modification of the above, is sometimes used. It is prepared as follows:—Extract 30 Gm. powdered Litmus with 500 Cc. of Distilled Water at 80° C., add Acetic Acid in excess. Evaporate on a water bath to a thick extract. Extract with 100 Cc. 90% Alcohol, then add 50 Cc. more of the same spirit, twice in succession, to remove precipitate from dish. Mix the whole and filter. Wash the filter well with the Alcohol. Dissolve the residue in the filter in distilled water at 70° C., and dilute to 250 Cc.

LACMOID chiefly Diazo-Resorcin Solution 0.2% in Dilute Alcohol.—P.J ii./08,194.

† Manual of Intragastric Technique. G. Herschell, M.D.

**Aseptic Lubricant Glycerin Jelly,** is used for assisting the passage of these tubes. A Glyco-gelatin Pastil of Menthol, gr. $\frac{1}{12}$, with Cocaine Hydrochloric $\frac{1}{20}$ grain, is also useful to be sucked just before passing.

**Inflation of the stomach for diagnostic purposes** is best carried out by the double bellows of a spray apparatus attached to a stomach tube.

A method of inflation is by giving first Tartaric Acid, 30 to 90 grains in water, followed immediately by 40 to 120 grains of Sodium Bicarbonate, and another is by Auto-inflation by means of Spivate's tube.

**Portions of stomach contents are removed** to examine for acidity, to ascertain the presence of food, mucus or gastric secretion, when it should normally be empty ; to examine test meals and to search for pus, blood and bacteria.

**Dunham's Tassel** consists of a little tassel of thread soaked in Dimethyl-amido-azobenzol Solution. It is attached to a thread, the patient swallows it, it is removed after an interval, and the resulting colour gives the condition of the stomach as regards free Hydrochloric Acid

**Turck's Capsule** consists of a Planten Capsule, No. 00, enclosing a small rubber tube attached to a thread for withdrawing, and provided with strips of Congo Red, Blue Litmus and Dimethyl-amido-azobenzol papers ; after swallowing and withdrawing, the resulting colours will be :—

1. If stomach contents neutral, no change in colour of any of the Papers.
2. If no free acid, but only combined acid and acid salts, the Litmus will be red and the others unaltered.
3. If there be free organic acid, but no free Hydrochloric Acid, the Congo Red will be blackish blue, but the Dimethyl-amido-azobenzol Paper will be unchanged.
4. If free Hydrochloric Acid present, all the Papers will be changed—the Litmus red, the Congo Red blue, and the Dimethyl-amido-azobenzol Paper will be red.
5. If both Hydrochloric and Lactic Acid be present, the Congo Red Paper will have a blackish tinge.

The rubber tube will contain sufficient material for microscopic examination, *e.g.*, for the Oppler Boas Bacillus or Sarcinæ.

By means of **Einhorn's (silver) Stomach Bucket** a small quantity, about 2 Cc., may be lifted up out of the stomach and examined. By **Salzer's** method a small quantity may be pipetted out of the stomach with a stomach tube. By **Turck's Aspirator Bottle,** which is exhausted by means of a bulb, the stomach contents flow into the bottle. This is one of the simplest methods of removing stomach contents.

The **Water Test** for myasthenia consists in introducing into the stomach 300 Cc. of water first thing in the morning, fasting, and 1½ hours afterwards another 100 Cc. containing 1% of glucose. In due course a small quantity of the stomach contents are removed and the sugar estimated (p. **171**, *et seq.*), from which is determined the amount of the original 300 Cc. remaining in the stomach.

**Ewald's Test Breakfast** consists of two or three ounces of dry bread and 10 ounces of hot water, or weak tea without milk or sugar. The Lactic Acid in bread vitiates the results where the presence of this acid is of importance, as in the early stages of cancer.

**Boas's Test Breakfast** (given after lavage) consists of one full tablespoonful of oatmeal to a quart of water, reduced to a pint by boiling. There are a variety of other test (meat and bread) meals.

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The following are abstracts from the works of Willcox, Herschell, Martin and others :—

**Chemical Examination** of the gastric contents after a test meal, containing little proteid and nitrogenous bases.—Willcox, L. ii./08, 220:—

The Hydrochloric Acid in this case will be present as far as possible in the free condition (which is the point of importance in diagnosis of gastric ulcer).

**I. Total Acidity.** Determine whether there is active Hydrochloric Acid or a mixture of this and organic acid. Usually in chronic gastritis acidity is low. In gastric ulcer it is high. In carcinoma it is usually low. (A normal acidity does not exclude gastric carcinoma.)

**Litmus Paper** is affected by Hydrochloric, Lactic and Butyric Acids.

**Congo Red Paper.** As already stated—the colour caused by organic acids will disappear on warming over spirit lamp whilst that due to Hydrochloric acid remains.

**II. Hydrochloric Acid,** This, according to Willcox, is either (a) **free** (b) **combined** with proteid and organic bases (i.e. **physiologically active**). (c) **Inorganically** combined (i.e., **physiologically inactive**).

(a) **Günzburg's test** for **free Hydrochloric Acid**:—

Phloroglucin 2 Gm., Vanillin 1 Gm., Alcohol 90% 30 Gm. A rose red colour formed on warming a few drops with an equal amount of the specimen in a porcelain dish indicates presence of the Acid. May also be best kept in powder form—2 parts of Phloroglucin and 1 part of Vanillin. As much as will lie on the point of a penknife, added to few drops of alcohol, forms a perfectly reliable solution. This is the most trustworthy.

Response to **Dimethylamidoazobenzol** may be given by organic acids if these are present in large amount. The latter may be used first, followed by Gunbzurg's test as confirmatory. If the test meal has been such as to give the Hydrochloric Acid the opportunity of being present in the free condition, then in normal gastric contents it will usually be present.

In *gastric ulcer* and hyperchlorhydria always present; in carcinoma scarcely ever present.

Milk is, of course, unsuitable as a test meal.

**Boas' Test for Free Hydrochloric Acid.**—Resorcin 5, Cane Sugar 3, Alcohol 100. This test is used exactly as Gunzburg's test, the same red color being produced, but Boas' requires heating more carefully, as it chars more readily and the color is not permanent.

(*b*) **Physiologically Active Hydrochloric Acid,** *i.e. Free* and combined with proteid and organic bases (normally about 0.15%).

**Willcox's Modified Volhard Method.**

Two equal quantities of gastric contents are taken, one rendered alkaline with soda,—both are evaporated and ignited. In one case the *Total* Hydrochloric Acid, and in the other the Hydrochloric Acid combined with inorganic bases only is obtained. Difference gives *Active* HCl. In gastric ulcer and hyperchlorydria the Active HCl. is equal to or nearly equal to the total acidity, and is usually over 0.15%. In gastric carcinoma the Active HCl., as found by Willcox, is nearly always much reduced,—always under 0.1%. In chronic gastritis the Active HCl. is often below normal.

**Differential Estimation** of **Physiologically Combined** and the **Free Acid.**

The fluid is titrated with Alkali in presence of Dimethyl-amidoazobenzol as indicator, the result being the physiologically combined + Free Hydrochloric Acid; then another portion is titrated with Alizarin Red (1% Aqueous Solution) as indicator, which gives Free Hydrochloric Acid only. The amount of alkali required in first titration minus the amount required for the second titration is the amount required by the *Physiologically Combined Hydrochloric Acid, i.e.* Hydrochloric Acid *combined with proteids and other weak bases, e.g.*

1st titration showed 0.2% calculated as Hydrochloric Acid.
2nd titration showed 0.15% Free Hydrochloric Acid.
0.2—0.15 = 0.05% Physiologically Combined Hydrochloric Acid.

**III. Organic Acid, Lactic Acid.** According to Willcox *great* importance should not be attached to presence or absence of this acid. Organic Acids in considerable amount are present in carcinoma of the stomach and where much fermentation is going on. By others, again, the presence of Lactic Acid is considered of grave importance, especially if in considerable quantity, *v. infra*.

**Uffelman's Test** for **Lactic Acid** —(not entirely satisfactory). Ferric Chloride Solution 1 drop, Phenol 0.4 Gm., water to 50 Cc. (Delicacy limit 1 : 10,000—the violet colour changes to yellow.)

An approximate estimation may be conducted as follows :—

Distil off 30 Cc. from 40 Cc. of the filtered stomach contents the total acidity of which is known. The volatile acids go over ; the residue contains the Lactic and Hydrochloric Acids. The acidity of the distillate (found by titration with N/$_{10}$ Soda, using Phenolphthalein as indicator) deducted from the total acidity " A " (found by titrating 10 Cc. of the filtered stomach contents in the same manner, the result being expressed in terms of Hydrochloric Acid) gives the amount of Lactic and Hydrochloric Acids together. If the amount of HCl " H " (found in the same way as " A," but using Dimethyl-amido-azobenzol as indicator) be deducted from this, the remainder is **Lactic Acid**.

**IV. Mucin.**. Important. In gastric ulcer and hyperchlorhydria usually absent. In gastric carcinoma a definite precipitate occurs on adding 2% Acetic Acid. In simple gastritis often present in small amount.—Willcox. It is soluble in Sodium Hydrate Solution. Dried film is deeply stained reddish violet by Thionin Staining Solution.

**Mucus** normally is stained faintly, but that met with in chronic gastritis deeply with Methyl Green.

**Blood** is recognised microscopically.

**Ferment Activity.** Determination of Pepsin and pepsinogen present is of great importance. Willcox has devised a NEW METHOD:—

Action on milk by determination of the activity of the gastric juice by **Rennin** contained (usually proportionate to Pepsin) by using a series of tubes containing 5 Cc. of milk, to which are added gradually increased quantities of the gastric juice, and the mixtures maintained at 40° C. for 30 minutes. About 0.2 Cc. of normal gastric juice (of the adult) is required in this test.

In *gastric carcinoma* much more.

In *gastric ulcer* and hyperchlorhydria usually less (0.05 or less).

In certain cases it may be necessary to estimate **Renninogen**,—consult the paper.

**Rennin** is tested for by adding a few drops of the filtered and neutralised stomach contents to two or three Cc. of milk and maintaining the mixture at 98° F. for a quarter of an hour, resulting coagulation indicates presence.

For testing for **Rennin Zymogen**, a small quantity of Calcium Chloride is added prior to incubation. A pocket incubator may be used for these experiments.

Tables in which the analytical data had been obtained are provided of cases of :—

(1) gastric ulcer and hyperchlorhydria,(2) gastric carcinoma,(3) mucous colitis, (4) stomach normal, (5) chronic gastritis, (6) gastric ulcer.—L. ii./o8,220.

Digestive activity of the stomach contents (*i.e.*, amount of Pepsin secreted) increases or diminishes with the amount of Hydrochloric Acid secreted by the mucous membrane. A number of cases of gastric carcinoma compared with cases of ulcer and functional disease showed that on the whole the greater proportion of cases evidenced a great diminution of acid secreted, as well as diminution of digestive power.—S. Martin, L. i./o9,398.

**Simple methods of Diagnosis in Disease of the Stomach :—**

This paper differs in some particulars from the views of the previous writer.

For practical purposes, as all that is required to know is *whether the free Hydrochloric Acid is normal, subnormal, or excessive*, the author has devised a special tube for estimating. To the point " A " on it a filtrate of gastric contents is introduced. A drop of mixed Phenolphthalein and Dimethylamidoazobenzol is added, then drop by drop N/10 NaOH Solution till the red colour has disappeared. The marks on the tube show whether the amount corresponds to a normal, sub-normal or excessive value for *free* HCl. N/10 NaOH is again added till the red colour of the *Phenolphthalein* appears,—this gives the *Total Acidity*.

When there is free Hydrochloric Acid it is no use testing for Lactic Acid.

When there is normal total acidity lactic acid is rarely present, but when no free Hydrochloric Acid and total acidity is low *Lactic Acid* must be tested for.

Lactic acid denotes subacidity combined with stasis due either to pyloric obstruction or fermentation due to an ulcerating growth. These two factors occur together in carcinoma and rarely in other diseases. A well-marked reaction with **Uffelman's Test** (*q.v.*) must be obtained to be any evidence.—L. i./09, 526.

In gastric ulcer, results with test meals indicated in the majority of cases excess of free Hydrochloric Acid.—L. i./09,764.

Contrary to Prof. Moore, Copeman and Hake find the physiologically active Hydrochloric Acid in mice and rats with transplanted or spontaneous tumors, is not only not diminished, but for the most part is in slight excess above the normal.—L. i./09,755.

Cancer in stomach and liver found by exploratory operation after free Hydrochloric Acid has disappeared from the gastric contents.—B.M.J. i./09,650.

Free Hydrochloric Acid is diminished in many cases of carcinoma of the stomach. In 10% of cases it is increased. L. i./09,915.

Considerable diminution helpful in diagnosis of ? gastric carcinoma.—B.M.J i./09,829.

The estimations of little value in early cases.—B.M.J. i./09,833.

Topfer's method of estimating Free Hydrochloric Acid criticised. Results of this paper indicated that the presence of an ulcer in the jejunum was connected with the large percentage of Free Hydrochloric Acid present in the jejunal contents.—B.M.J. i./09,1232.

The **Oleic Acid Method** of diagnosing gastric malignant disease, *v.p.* **204.**

HYPERCHOLORHYDRIA AND ITS COMPLICATIONS.—W. Russell was the first to clearly differentiate hyperchlorhydria from other gastric ailments. The purpose to which Hydrochloric Acid is applied is in acting with Pepsinogen. It is said that digestion never fails from deficiency in Pepsinogen because of its great power even in small quantity. The symptoms of hyperchlorhydria are burning pain at the cardiac orifice of the stomach, acid eructations, waterbrash, usually flatulence and constipation. In some cases there is a sense of dragging or weariness or a hunger discomfort coming on two hours or less after breakfast, and removed by taking a glass of milk a drink of cold water or sodawater or a cup of tea. Somewhat later in life there is much gastric discomfort or definite pain coming on an hour or two after a meal. This is associated with mental depression and great difficulty, amounting in some cases to complete incapacity, for mental or physical effort. On removing the gastric contents in such cases they are found to be intensely acid and to contain much free hydrochloric acid. That this hyperacid fluid is the cause of the pain and depression is proved by the immediate relief of the symptoms when it is withdrawn. A *simple test* in Scotland for digestive conditions is the following :—If *porridge and milk cause acidity* the digestion is not right. Sodium Bicarbonate not only counteracts the free Hydrochloric Acid, but also inhibits acid secretion. For inhibition of secretion Belladonna is best.—B.M.J. ii./10,2014.

Some authorities are of opinion that *no such condition* as hyperchlorhydria really exists, and that an ordinary " acid dyspepsia " due to an excessive secretion of normal gastric juice is capable of causing most of the symptoms ascribed somewhat indiscriminately to hyperchlorhydria and duodenal ulcer. This opinion is strengthened by the fact that estimates of free Hydrochloric Acid have proved inconsistent.—B.M.J. ii./11,1528.

The pain of GASTRIC ULCER has been attributed to an excess of Hydrochloric Acid acting on the affected membrane. 0.5% Hydrochloric Acid applied to an abrasion of the skin produces smarting and might be expected to cause pain in a gastric ulcer, but was quite tolerated when 4 ounces were introduced into the empty stomach by a tube where gastric ulcer was subsequently diagnosed by operation. Similarly HEARTBURN has often been ascribed to the regurgitation of the Hydrochloric Acid into the œsophagus, but some observations negatived this also ; nevertheless the Acid is in some way evidently connected with the production of the pain, as Alkali relieves it.—L. i./11,1215.

Test for the products of **Starch Digestion.** The presence of Erythrodextrin in any quantity (giving a brown colour with Lugol's Solution) one hour after a test breakfast will point to hypochlorhydria.

**Gunzberg's Capsule,** for testing digestive power, consists of $\frac{5}{16}$ inch of thin rubber tubing, $\frac{1}{8}$ inch in diameter, containing $1\frac{1}{2}$ gr. Potassium Iodide plugged with pledgets of Fibrin at each end.

**Fermentation** is examined by means of an ordinary Doremus Ureometer. Estimation of the **digestive power** of the gastric juice is effected with hard boiled egg by examining for peptone after two hours or so at 40°C.

**Keratin Coated Planten's Capsules** (largest size), filled with **Bismuth Carbonate**, and **Chain Cachets** (2 inches of fine silver chain in a cachet attached to a piece of silk), are used for **X Ray examination** of the stomach. Bismuth is also used *c.f. Vol. I p.* 217, 220.

**Microscopic Examination** reveals starch, sarcinæ and the **Oppler Boas Bacillus**, present in malignant disease—stained with Methylene Blue.

For **Lavage**, a stomach tube, funnel, and graduated jug may be used;

On **gastroscopy**—a plea for its routine employment by gastric experts. Topical applications by means of the method can be made to ulcers, portions of a tumour can be removed for microscopic examination and a pin or needle sticking into the gastric mucosa could be released or retrieved.—William Hill, B.M.J. ii./09,843; B.M.J. ii./11,1074; see also *Vol. I p.* 694.

**Tropæoline OO** and **Methyl Orange** (Helianthin) *Official Solution*-Methyl Orange 0·4, Alcohol (90%) 50, Water to 200, are yellow colours used for testing for the presence of free acids. The former is changed to crimson by acids, the latter to pink, but no change is produced by Carbon Dioxide, Acid Carbonates or Metallic Salts. For further details as to use as indicator in titrating alkaloids &c., *v.* Allen, vol. ii., part 3, '07, 136, *et seq.* Not suitable for organic acids (except Oxalic). 1% solution recommended.—P.J. ii./08, 194.

**Rosolic Acid**, *Syn.* AURIN, CORALLIN.

1% in 60% Alcohol. Rose red with alkalis and yellow with acid. Remove $CO_2$; not suitable in presence of $NH_3$.—*Ibid.*

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## III.—BACTERIOLOGICAL AND CLINICAL NOTES

## with reference to Special Diseases.

[A cabinet is arranged containing the Apparatus, Stains and Solutions necessary for taking and examining **Diphtheritic** Scrapings, for detecting the **Gonococcus** in discharge, for staining Sputum for **B. tuberculosis**, for collecting Blood for **Widal's Typhoid Reaction**, for the **Gram** separation of Organisms, and for all other general clinical diagnoses.—B.M.J ii./00,332; L. ii./00,1282.]

**Acne Vulgaris.**—Fleming (B.M.J. ii./09,533) describes the bacteriology of acne vulgaris. Gram positive organisms which, when seen in pus, are arranged very irregularly, frequently inside polynuclear cells. Occur alone or together with Streptococci. For further and more recent data see **Acne Vaccine**. *Vol. I p.* 868.

**Actinomycosis.**

A parasitic disease, due to the 'ray fungus,' first observed in cattle (wooden tongue), characterised by chronic inflammation, with or without suppuration, frequently resulting in formation of granulation tumours, especially about the jaws. *Vide* Potassium Iodide, *Vol. I p.* 635 for treatment.

*To identify the fungus.* 1. Place specimen, pus or sputum, in a flat glass dish on a black surface. Remove the characteristic yellowish particles if found, and carefully tease out on a micro-slide or cover-glass. 2. Fix film over the flame, *s.a.* Stain by the Gram-Eosin method, *v.* p. **258**.

The violet stained mycelium of the fungus as tangled webs or scattered filaments will be seen on a pink ground (leucocytes, epithelia, &c.), with a ⅛ inch or even ⅔ inch objective.

The "rays" (see M. and R., etc.) may be observed without staining, but the stained specimens are confirmatory and valuable for reference. N.B.—They are not found in man—only the filaments.

Primary ovarian actinomycosis, a case of. Only six cases on record. Here the ovary was the primary seat of infection, and hence unique.—L. i./09, 758.

A case of actinomycosis (streptotrichosis) of the lung and liver successfully treated with vaccine. The vaccine in this instance was standardised by weight, 1 Cc. = 1 mgr. "Antimycotin." B.M.J. i./08,551.

A case of Actinomycosis of the lungs.—B.M.J. i./12,302.

**Anthrax.**—*Bacillus Anthracis* was probably the first bacterium to be recognised inasmuch as it was associated with splenic fever as long ago as 1849. It is responsible for 'malignant pustule' in man. If an animal die suspected of the disease the mode of examination is to cut off the ear and submit the blood from the same to bacteriological examination. The organism does not spore in the body of the animal, but if the air gain access, as in the case of an ordinary post-mortem investigation, the organism spores rapidly and hence becomes a grave source of danger.

Chemistry of the Toxin.—P.J. ii./05,331.

The organism almost invariably occurs as long filaments, particularly in broth cultures (is non-motile). It grows on all the ordinary media both at room and body temperature, and produces in gelatin 'stab' cultures, typical 'inverted fir trees appearance. By growing at 42°C. a non-sporing form can be produced, which is the mode of attenuation for the immunisation of animals, as introduced by Pasteur. The spores retain their vitality and pathogenicity for years in the dry condition. Martin has shown that the organism produces an alkaloid which is the fever producer and an albumose which induces the coma. The malignant diseases which the organism produces in man have been satisfactorily treated by Sclavo's Serum (see p. 869. or by excision. If not diagnosed in time the organism may invade the blood stream, causing death, with symptoms of splenic fever, but the spleen is not so enlarged nor the bacilli so numerous in the organs.

Changes which occur in growth of the organism.—B.M.J. ii./11,1665.

Staining of the blood may be conducted by Gram's method (counterstaining with Eosin), also by Alkaline Methylene Blue. It is Gram staining.

**Appendicitis.**—Common intestinal parasites seem to be associated with this disease, *e.g.*, *Ascaris lumbricoides* and *Tricocephalus dispar*. Chauvel has pointed out that appendicitis appears to be the most prevalent among meat-eaters, and notably beef-eaters. It is, on the other hand, unknown amongst Arabs or the Chinese. In religious communities in Brittany where meat is never eaten, appendicitis is unknown.

Disease of the vermiform appendix may be initiated more frequently than is commonly supposed by entozoa, *e.g.*, *Oxyuris Vermicularis* and *Trichocephalus Trichiurus* may prepare the way for bacterial infection. B.M.J. i./10,42.

CAUSE OF.—The actual cause of the inflammation of the appendix is probably microbial. Decomposing meat—meat kept until tender, game hung until it is high, tinned meats, etc., are considered dangerous,—cooking is not always efficient,—in fact tinned foods are thought to be virtually associated with appendicitis.—B.M.J. ii./11,1343.

Why and how to preserve the appendix.—Keetley.—L. i./09,1.

**Beri Beri.**—This disease infests the Federated Malay States and parts of China. Its exact cause still remains undetermined, though its 'cause' has been traced to 'polished' rice. It has been found that the poorly nourished are more liable to contract it than those well fed.

The 'arsenical,' 'rice,' 'place,' and 'acute or subacute infectious disease theories discussed.—B.M.J. ii./05,1287. See also ii./06,1563. The bed bug is apparently not responsible for beri-beri. The bacillus usually associated with the disease has not been isolated nor found to fulfil Koch's laws.

***Treatment.***—Strychnine, Arsenic, and Silver Nitrate are in repute as soon as the muscular hyperæsthesia has subsided.—Sir P. Manson, 'Manual of Tropical Disease.' A routine which has found some favour is the following:—

Magnesium Sulphate 60 grains, Dilute Hydrochloric Acid 20 minims, Tincture of Orange 1 drachm, Infusion of Calumba to 1 ounce. Thrice daily for a week, and repeat after a few days intermission.

If much œdema, the following may be of use:—

Solution of Ammonium Acetate 1 drachm, Potassium Nitrate 10 grains, Potassium Acetate 15 grains, Camphor Water to 1 ounce. Thrice daily.

If the heart shows signs of failure, a mixture of Digitalis, Ammonium Carbonate and Compound Spirit of Æther may be used with advantage.—Brooke, 141.

Comparison between chronic oxalic acid poisoning and beri-beri.—B.M.J. i./07.709.

Experiments on monkeys suggest an infective protozoon organism eliminated in the urine by which the infection may be conveyed. Description of appearance of kidneys obtained from acute cases.—B.M.J. ii./07,202,1281.

Etiology of, if not its origin, has at least an intimate relationship with the consumption of white rice. No case among 273 people on parboiled rice. No distinctive organisms found either in blood or urine. Ankylostomes were not found as associated with the disease.—L. i./09.451,561. B.M.J. i./09,1007.

Leader on Beri-Beri.—Are the symptoms the result of a nitrogen starvation or due to a toxin produced in the rice by some organism ?—L. i./09,1333,1526

Etiology of Beri-Beri.—The addition of rice polishings to a diet of white rice is an effective preventive of the development of polyneuritis in fowls. Rice polishings comprise from 8 to 10% by weight of the original grain.—L. ii./10, 1775.

"Unpolished" rice contains 0.6–0.8% Phosphorus Pentoxide, the "polished" grains contain only 0.40–0.45%. Thus the polishing of rice in steam-mills removes substances essential for the nutrition of nervous tissue. Much could be done in prevention by improving the dictary—adding rice and wheat bran or substituting for part of the rice some other grain, *e.g.*, that of *Phaseolus Radiatus* —L. ii. 11,535.

Beri-Beri is independent of 'infection.' It does not occur in races using partly milled ('cured') rice. The Phosphorus content alone is altered, being on cured rice raised from some 2 grains to 4.5 grains $P_2O_5$ per man per day.—B.M.J. i. 11,1421.

The relation of the organic Phosphorus content of various diets to diseases of nutrition, particularly beri-beri. The salt meat met with in ships is said to have lost 50% of its Phosphorus under the pickling process—the deficiency of Organic Phosphorus in milled rice may be caused by the absence of some compound at present unknown.— L. ii./11,1087,1230.

The work carried out in the Institute for Medical Research, Kuala Lumpur has shown that deficiency of *Phosphorus* is not the cause of beri-beri,—experiments appear to prove that neither is a glucoside responsible.—L. ii./11,1364.

'Overmilled' would perhaps be a better term than 'Polished' rice. Rice thus 'polished is deprived of pericarp, subpericarpal layers and embryo or germ.—B.M.J. ii./11,1446. *Vide* also previous edition for earlier references.

Consult also *Nutrimenta* and *Phaseolus.*

## Blackwater Fever.

[Practical notes on treatment:—Calomel 5 to 10 grains, Effervescent Saline. Intravenous injection of normal Saline Solution, Quinine in nutrient enema (not milk), also Digitalis, and Strychnine in the same form.—B.M.J. ii./07,1324.]

Blackwater fever may be brought on by quinine and by antipyrin in people who have suffered previously from it or malaria.—Sandwith, B.M.J. ii./09,1801.

Investigation showed that all Sulphates lower the number of inorganic molecules in the blood, hence tending to bring the corpsucles to their hæmolytic point. Chlorides (Quinine Hydrochloride, Calcium Chloride; &c.) tend to increase the resisting power of the blood.—B.M.J. ii./08,65.

A case of malaria suffered from typical blackwater fever while under study in hospital. He had distinctly pyrexial periods all differing as to plasmodia, fever and hæmoglobinuria. There must be some subterranean factor at work—somo process different from the usual processes of ordinary malaria.—Prof. Ronald Ross.—L. i./11,585.

Quinine alone or malarial intoxication alone does not cause hæmoglobinuric fever—it is caused by one of these plus the toxin, accentuated during the course of one or more malarial attacks.—L. i./11, 702.

*Treponema Spirillum Verticale* said to be the micro-organism of blackwater fever—this is greatly questioned.—B.M.J. i./12,340.

**Bacillus Botulinus.**—This organism is found in a certain kind of meat poisoning designated 'botulismus.' An obligate anærobe, motile,—produces gas which splits up the medium in glucose agar stab cultures. It is Gram+ staining. Has terminal spores.

Bacteria of Poisoned Meat.—B.M.J. i./05,1257.

## Cancer, Sarcoma, and other Malignant Tumours.

### Imperial Cancer Research Fund.—9th Annual Report.—1910–1911.

"An important point which is brought out is that the increase of cancer during the last decade is referable to certain anatomical regions and not to others,—thus in males the increase is almost confined to the alimentary canal,—especially the stomach, while in females it mainly effects the same system, stomach and intestines, although the breast suffers also. Much has been done with regard to 'soil' investigation,—there would appear to be no special feature in it favouring the growth of cancer, for transplantable tumours grow as well in normal animals as in those in which they first appeared. Yet a spontaneous tumour can hardly ever be implanted into an animal in which there has arisen a spontaneous tumour. With regard to treatment, it has not been found possible to arrest growth of spontaneously arising tumours,—it is thought doubtful whether any real progress is to be made along these lines." Warnings as to irritation are repeated. Further, cancer is not "catching," and "cancer houses" cannot exist. Heredity plays a part in the development of cancer of the breast in mice. At all age periods the disease was more frequent when the mother, or either grandmother, or all three, had died from cancer of this organ. Resistance has not been induced either with an animal's own tumour or its own normal tissue. A number of cases of natural healing of spontaneous malignant new growths had been observed in mice affected with spontaneous cancer. "It is necessary to warn against needless alarm or the awakening of pessimistic anticipations of the outlook on future efforts to cope with cancer."—B.M.J. ii./11,171; L. ii./11,315,391. *See also* B.M.J. ii./11,1307; L. ii./11,1345.

The Fourth Scientific Report of the Fund shows that a portion of cancerous tissue transplanted to another part of the same body grows readily, while the attempt to graft it upon another individual is abortive or difficult. The cancerous overgrowth of tissue is usually, and perhaps exclusively, in some part of the body which has been subject to continuous irritation. Cancer of the generative organs has not increased at the same rate as that for other organs, and most of the increases affect the higher age-periods predominantly.

E. F. Bashford points out that the increase of cancer is real and not illusory—it is not due to a spread of infection. The common virus cannot exist for cat, mouse, and rat sarcoma, nor yet for sarcoma and carcinoma,—out of a pure adeno-carcinoma a sarcoma may develop in a certain number of instances. Embryonic mouse skin has extraordinary power of affecting a complete protection against mouse mammary carcinoma.

Dresden International Hygiene Exhibition.—B.M.J. ii./11,766.

Cancer—Bradshaw Lecture on :—

The living cancer-cell is the essential part of every cancerous growth, for when the cell dies it is impossible for any of the parts, agencies, or faculties of cancer to be excited or developed. In a successful graft the centrally placed cells die, but the peripheral portion of the transplanted tissue excites the surrounding fibrous tissue to form a support (stroma) for the tumour, whose soft tissues are wholly developed directly from the implanted living cancer-cells of the graft. Transfer of cancer from mouse to mouse is impossible if the vitality of the cancer-cells is impaired by pounding or by heat. On the other hand, inoculated infective granulomata show the fundamental difference that it is the host-tissue itself from which further growth results. A study of the cancer-cells demonstrates that it is only a variation of a normal cell, for it possesses neither in structure nor in power anything not found in the healthy cell. The established facts show that cancer-cells possess a great power of continuous multiplication, retaining inherited limitations to type of cells among which they first appear, but they develop and differentiate but little and irregularly in a manner neither purposeful nor effective. Beckton has shown recently that the tissue-cells of man contain, with particular exceptions certain granules, known as Altmann's granules, which are invariably absent in the cancerous growth proper. If this observation is confirmed it will not only be a very useful diagnostic character, but will also establish a morphological difference between cancer-cells and most normal cells, and afford anatomical proof that the former are not embryonic cells.

The potassium content of the red corpuscles of cancerous patients is approximately double that of healthy persons, although the amount of sodium is unchanged. Bashford has effected the artificial conversion of the malignant tumour of carcinoma into the soft cellular growths of sarcoma. This, as also the intimate connection shown between cancer-cells and the cells of the individual, make one unable to recognise in cancer an independent growth, parasitic or otherwise.

Cancer is cell-life that is disorderly, irregular, and with a minimum of development. It is a result of a breach or failure of fundamental cell-law—a law so majestic that obedience to it results in perfect health and disobedience to it means all the inscrutable woes of the dread disease.

Cancer is undoubtedly a disease that generally arises in cells that are growing, or have grown old, thus in woman the breast and uterus are prone to cancer as they get old before the rest of the woman. The different incidence of cancer in the two sexes is not a sex difference affecting all the body tissues, but is the result of the special liability to the disease of organs possessed by one sex only. A chart given in the paper clearly shows the close parallelism of the cancer curve, in women, and in their generative organs only (at 40 to 50 years of age), and the near approach of the curve for women, when we exclude disease of their generative organs, to that of men (at 50 to 60). Age, chronic irritation, $x$-rays, alcohol—all so-called causes of cancer—agree in being conditions that deteriorate the evolution of the individual cell and apparently lessen the latter's hold over the great primal cell-law. Cases of the disappearance of cancerous growths mentioned show that there is cure of cancer, apart from operative removal. "When the biologist shall know the laws that govern cell-growth, with a knowledge akin in its sweep and accuracy to that of the astronomer, he will have the power to prevent, to control, and to cure cancer."—Sir Alfred Pearce Gould. B.M.J. ii./10,1836 ; L. ii./10,1665 ; C.D. i./10,933.

## Imperial Cancer Research Fund, Eighth Annual Report (1909—1910).

Statistics of 13,000 cases, examined microscopically, from hospitals in England and Scotland have been published. The methods suggested by various workers for serum diagnosis of cancer had yielded negative results. Attention had been paid to malignant growths in cattle. Histological types comprised the majority of forms met with in man. Frequency of primary carcinoma of the liver associated with cirrhosis and primary malignant growths of the rarenal was of interest. Practically all mammary carcinoma of the mouse can be transplanted.

From observations showing the small proportion of successful transplantation of spontaneous tumours it is concluded that animals naturally the subject of cancer do not suffer from it because they present a soil uniformly favourable to the disease ; on the contrary the circumstances associated with the appearance and growth of cancer are peculiar to the individual attacked. The cancer cell although highly dangerous to the individual in which it arises may hence be relatively innocuous to other individuals.—B.M.J. ii./10,205 ; L. ii./10,241, 265.

Mice immunised subcutaneously by injections of Tumour or of norma tissue are resistant to the implantation of cancer in internal organs. The mmune state is one of general distribution throughout the organism and not of local occurrence at the site of the immunising inoculation.—L. ii./11,92.

Immunity Reaction to Cancer.—Bashford, vide P.R.S.M.Therap. and Pharm. Sect. Mar. 1910, p. 69.

In the **Third Scientific Report (Seventh Annual Report)** published **October, 1908,** injection of Trypsin was stated to have given entirely negative results.

No evidence proving hereditary transmission had been obtained (mice experiments). The law of age incidence in mice holds good in a manner comparable with that for mankind. No evidence to show that the disease in nature is conveyed by the transference of living cancer cells. (*c.f.*, Ninth Report). Fifty mammary carcinomata under propagation in the laboratory, all different. A much larger variety of malignant new growths exists than formerly supposed. Further detailed investigation as to manner in which animals may be rendered resistant to the inoculation of cancer. It was found that cells, whether cancerous or normal, which had been killed or disintegrated in any case, such as by chemical properties, or by heat, cold, crushing, &c., were entirely deprived of their power of conferring resistance.—this in complete contrast to that obtained when the organisms of infectious disease were similarly killed or disintegrated, as in those the products retain poisonous properties and powers of inducing resistance. The action of **Radium** on normal and cancerous tissues without causing disintegration was of *special interest.* After applying Radium for an interval *within which no structural alteration could be observed in the tissues, they might be completely deprived of their powers of growing and immunising.* Abolition of vital properties with retention of histological structure and intactness of the cells. Experiments showed that the power to elicit these biological reactions was internally bound up with and dependent on the vital acticities of the cells themselves. Until now the parallel behaviour of the normal and cancer tissue in these respects almost excluded the possibility of Radium having selective action on cancer tissues. Pending *proof of existence of selective action exaggerated hopes should not be diseminated.* Data from outlying parts of the Empire included in particular search for peculiar forms of *chronic irritation* associated with occurrence of malignant new growths in native races. A new and most interesting point from Egypt was the occurrence of cancer of the skin of the chest on the triangular area of the skin left bare by the clothing worn by the Fellahin.

Seven years ago no one would have conceived it possible that portions of the *mammalian organism could be kept growing* for a period four times the length of life of the whole animal. While some chance opportunity may yield results of immediate practical moment, the outlook in therapeutics in the meantime is directed to preventing dissemination or metastasis.—E. F. Bashford, General Superintendent's Report.—B.M.J. ii./09,151.

The chance of a man who reaches 35 eventually dying of cancer is 1 in 12, of a woman 1 in 8,—the figures for the two sexes are approximating as time advances.

A fragment of cancer tissue transplanted to a previously normal mous induced an increase in the amount of physiologically active Hydrochloric Acid during digestion. Mice which had been apparently completely protected against the inocculation of cancer had developed the disease spontaneously.—B.M.J. ii./07,26.

Cancer occurs in nearly all verbetrata, not in the higher types only. The malignant growths in all are identical. Transmissibility from one lower animal to another of same species possible. Cancer is transmissible to others and has an external origin. Contamination by food. Cremation of all who die from cancer essential.—L. i./03,80.

Plimmer's bodies, which were considered peculiar to cancerous tissues, are also present in healthy reproductive tissues. This disposes of the idea hitherto held that Plimmer's bodies are parasitic organisms.—C.D. i/05,793.

Experiments on mice. Action of Mercuric Chloride, Iodide, Potassium Cyanide and Ammonium Fluoride on tumours. Chemical analysis of 300 tumours showed preponderance of Potash Salts and nucleo-proteid content associated with high virulence and rapid development.—B.M.J. ii./06,1548.

Living cancer tissues from English mice implanted on to newly imported foreign mice causes a certain amount of resistance to the growth,—only a small percentage of the inoculated mice develop tumours.—National Cancer Research Fund.

Cancer research at the Glasgow Cancer Hospital on the following lines:—The cytological investigation of malignant growths; chemical investigations; experimental work with malignant growths occurring in animals. Experiments with **Sera**. Two Sera were used, both obtained from rats; In the case of one of these the rats were inoculated with living cells of mouse cancer, and in the case of the other with living cells of mouse testis. Both sera were curative when injected into mice with well established tumours. The original article must be consulted for further detail.—L. i./11,1275.

The final victory over cancer will not be solely by the knife.—B.M.J. ii./06,1681.

Tables giving relative frequency of cancer in various organs—male and female.—B.M.J. ii./11,1244.

Cancer, the role of fat in the etiology of.—It is possibly the tissue which plays an important part both in the etiology and certainly in the progress of the disease. Note the pigmented condition of the fat in some cases of carcinoma *p.m.* In operating on mammary cancer the oily and fluid state of the circummammary fat is very noticeable. In those cases where oophorectomy for inoperable mammary cancer produces disappearance of outward signs of the disease there is improvement in general health and increase in subcutaneous adipose tissue. **Chemical Examination of Fats**—normal human and cancerous, gave interesting data. The fats were extracted by heat and examined for Iodine Nos. with Wij's Solution—there was decided difference in human fat before and after puberty—44.477 average Iodine value (= % of non-saturated fatty acids) between 9 and 11 years, and 60.88 between 16 and 19. Fat in health gave average Iodine value 62.1 and in cancer patients 72.62. Protoplasm according to latest views is an emulsion of proteins and lipoids, *i.e.*, there are cell fats, and any causes that make them more fluid lead to degeneration and destruction. What effects an excess of non-saturated fatty acids in the cells of adipose tissue of a part may have on surrounding somatic cells must be a matter of conjecture. Further research and enquiry necessary.—L. i./11,1560.

### *Diagnosis and Operative Treatment of Cancer of the Breast.—*

Immersion of a piece of growth removed at the operation in 5% Nitric Acid Solution for a few minutes, and then washing same in water will enable the surgeon to distinguish between a localised mastitis and a carcinomatous condition. The difficulty is to determine how far the induration is dependent on sclerosed fibrous tissue and how far on epithelial proliferation. The acid treatment renders the epithelial elements opaque by coagulation of the protoplasmic epithelial cells, while the connective tissue elements are rendered more or less translucent and gelatinous. Amount, arrangement and distribution of the epithelial elements enable one to say whether one is dealing with a carcinomatous state or with a mastitis associated with a simple hypertrophy of the ultimate globules of the gland parenchyma.—Sir W. Watson Cheyne.—B.M.J. ii./08,972.

Immediate microscopic diagnosis of tumours at the time of operation.—L. ii./10,939.

*Diagnosis of Cancer by examination of the blood* :—

**Antitryptic Index.**—*The power of any given serum to inhibit tryptic digestion compared with that possessed by a normal standard serum.* The Antitryptic Index was found to be raised in 94% of casesof malignant disease. The reaction is, however, not specific, as most processes involving cell destruction produce a heightening of the index. There are several methods of obtaining the results, one chemical, another electrical, and a third by estimating vicosity of the serum.

Gastric ulcer can be distinguished from carcinoma of the stomach by the test. The electrical method registers more definitely than the chemical one,—details of procedure. The negative evidence afforded by a normal antitryptic index is of great value in excluding malignant disease.—B.M.J. ii./09,1220.

A raised antitryptic content often assists in distinguishing between an innocent neoplasm and a malignant one, but does not justify a positive diagnosis of cancer.—B.M.J. ii./09,969.

The electrical conductivity method is described. L. i./09,968. During a tryptic digestion the rise of electrical conductivity of the digest is an accurate method of following the course of the reaction, and with it extremely small quantities of serum can be used.

The viscosity method of estimation depends on the changes of viscosity taking place during the process of digestion. Yields very reliable results.—B.M.J. ii./09,1058.

In diagnosis of cancer of the stomach Hydrochloric Acid must be persistently absent from stomach contents—distinction from gastric ulcer and dyspepsia.—B.M.J. i./07,746.

*Recognition of Cancer of the Stomach.*—Stress has been laid in the diagnosis of carcinoma of the stomach upon the *absence of free Hydrochloric Acid* and diminution of the total acidity of the gastric contents removed after a test meal,—there are, however, so many exceptions that too great importance must not be attached to it. In chronic gastric ulcer and in carcinoma originating in chronic ulcer free Hydrochloric Acid is usually present in about normal amount,—sometimes slightly in excess, and the total acidity corresponds. In old standing cases with many years' history which may be chronic ulcer, or may have overstepped the line and become malignant, no nformation of value is given. In chronic gastric ulcer apart from growth very rarely, in carcinoma of other organs commonly, and after severe hæmorrhage, free Hydrochloric Acid may be absent. These exceptions to be borne in mind in considering the value of absence of free Hydrochloric Acid and diminution of total acidity.—B.M.J. i./11,1458. *Vide* also p. **195**, **196**.

**Glycyl Tryptophane**, used in diagnosis of gastric carcinoma. The details are too lengthy for inclusion,—original paper should be consulted.—L. i./11,731.

**Oleic Acid method of diagnosis of Gastric Carcinoma.**—Following on the method of diagnosis which an ether extract of the gastric contents after a trial breakfast is examined as to its hæmolytic power, and which was thought to be of positive value for cancer of the stomach, Graefe and Röhmer are inclined to the view that hæmolysis may be due to Oleic Acid. It is never present in normal persons. A method is employed by which Hübl's Iodine Solution, *vide* p. **39** is used,—the amount of this necessary beyond the normal limits is taken to indicate presence of Oleic Acid. Out of 77 non-malignant cases it was only present twice, and in 22 undoubted cases of cancer the acid was present in all but one, in which there was marked gastrectasis. The test is not difficult to carry out.—B.M.J. ii./10,1645,—ex Münch. Med. Woch., Sept.20/1910.

Early diagnosis and treatment of cancer of the stomach. Evidence of impairment of the motor functions of the stomach, and of a diminution of the Chlorides in the gastric juice.—B.M.J. ii./10,953.

Sulphur, Hydrogen Peroxide, and Manganese Dioxide as test for carcinoma.—M.P.C. ii./11,533.

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For some practical methods *vide* Diagnosis of Morbid Tissues.—O. C. Gruner.—M.A., 1911,104.

Pelvic examination prior to operation should never be omitted. The earliest visceral deposits may be found in the pelvic cavity. The liver is usually the first part of the body to be attacked.—S. Handley.—B.M.J. ii./08,978.

Recurrence of cancer has been cured by " X " ray treatment, hence recommended as prophylactic.—B.M.J. ii./08,976.

The ' only chance ' doctrine of present day surgery is responsible for much disappointment to the public and discredit to surgery.—B.M.J. ii./08,980.

Technique of cancer operations with reference to danger of cancer infection.—B.M.J. ii./08,1005.

Protozoan origin of tumours. The authors state they can demonstrate in many tumours bodies that are obviously protozoa, as also portions of a life cycle.—B.M.J. ii./09,868.

Treatises on Protozoa.—Na., Mar. 3/10, p. 1.—B.M.J. i./10,142.

Possibility of a casual parasite cannot be denied. Coccidia theory not tenable. Actual results in treatment with Atoxyl—nil.—B.M.J. ii./08,1509.

A real increase of cancer cannot be proved. The stomach is the seat of the disease in nearly 22% of the fatal cases in males in England and Wales In females the generative and mammary organs are affected in more than $\frac{2}{5}$ of the total cases. Whether cancer is transmissible by heredity in man has not been settled one way or the other. Importance of animal (mice) experiments being conducted under identical condition is emphasized. Old mice are not such good ' soil ' for tumours as young ones. Animals can be rendered unsuitable for inoculation and growth of cancer by treating them with malignant new growths, or with normal tissues of their species. After exposure to **Radium** for an interval not long enough to cause any naked eye or microscopic alteration in the tissues, they may be completely deprived of their immunising or growing powers.

Cancer cells, even when of the same organ have been resolved into a larger number of varieties able to maintain the individuality than was previously conceivable. *No evidence has been obtained in favour of embryonic explanation of etiology, nor any analogy with known forms of infective disease.* At the present time the number of different kinds of tissues being propagated separately make it possible that the majority of the tissues, once they have acquired cancerous properties may be grown and segregated—in otherwords—*a living animal can be analysed into many of its components parts.*

Cancer is not limited to white men. 25,000 deaths annually from it in Japan. It is not, as usually supposed, rare in any quarter of the globe.

Old mice (and human beings) are more susceptible than the young. Location of the disease due to irritation is dwelt upon. Strong arguments against infective causation of the disease given. Mice and rat cancer distinct. Bashford, 16th Inter. Cong. of Medicine, Budapest.—L. ii./09,691; B.M.J. ii./09. 797.

Parasitic origin doubted. Cancer held to be 'a biological syndrome (symptom complex) caused without any extrensic specific parasite or irritant by intrinsically arising mechanical forces, which are excessive in degree when the muscular mechanisms of the body, especially those of equilibrium and respiration, are chronically used other than to maximum or, at least, very high efficiency.' The power is expended unproductively being transformed into energy of undue cell growth. This forms the local irritant factor. The same low efficiency use of the muscular mechanisms (especially of equilibrium and respiration) which cause irritation (much power lost and wasted in doing internal work) result in impaired oxygenation of the blood, defective aspiration, etc., and general splanchnic stagnation, intestinal toxæmia and non-elaboration of essential internal secretions, alexins, opsonins and ferments. Perfect cell tissue becomes impossible. Thus arises a cachexia, which may precede or follow the local proliferation. When these two factors, the epithelial proliferation and the cachexia are at work each reacts on and intensifies the other. Each produces its own poisons in ever increasing bulk,—the biological syndrome is complete, and advances to the fatal end. Seanes-Spicer.—B.M.J. i./09,1151.

An investigation '*in vitro*' to throw light on the nature of cancer. The existence of an exciter of reproduction of human lymphocytes is *inter alia* pointed out. A mixture of Methylene Blue and Atropine excites amœboid movement in leucocytes. So does the blood of a cancer patient. The same mixture will cause lymphocytes to extrude flagella with a particle of chromatin at their ends. The plasma of a cancer patient does the same. The authors showed that the extrusion of chromatin appears to be a phenomenon which occurs in cancer cells and that cancer cells appear to produce "something" that aggravates the disease,—the "something" is possibly chromatin.—B.M.J. ii./09,1212.

**Chemical irritants** said to favour onset of cancer, particularly some coal-tar products.—B.M.J. ii./09,1215.

Following on this, **Sulphurous** and **Sulphuric Acids** are blamed as cancer producers. $SO_2$ is introduced into all wines and preserved fruits because it counteracts acetic fermentation. Organisms morphologically identical with *Plasmodiophora brassicæ* have been found on cancerous tumours which organism has been stated by the Board of Agriculture to be fostered and encouraged by Sulphuric Acid manures. Scrotal cancer is found amongst guano workers, chimney sweeps and coal-tar workers. Guanos have now to be extracted by means of Sulphuric Acid. If no connexion between these Acids and cancer the deductions depend on extraordinary series of coincidences. Convinced as to parasitic nature of cancer.—B.M.J. ii./09,1716. The Sulphuric theory is thought to be built on rather slender formation. There is little doubt that workers in certain coal tar compounds do develop cancer frequently, but this is hardly sufficient to base a theory on.—B.M.J. ii./09, 704.

Cancer cannot grow in acid medium,—on the contrary, acids, *e.g.*, **Acetic Acid** in weak solution as douche twice daily in a case of cancer of cervix uteri was curative.—B.M.J. ii./09,1441.

In inoperable cancer the **thyroid gland** has been *removed* as the best means of ameliorating the disturbing factor. There would seem to be increased thyroid activity in carcinomatous sufferers.—L. ii./09,1138.

Cancer, like all "new growth," must be regarded in the light of an adaptive response on the part of certain cells or cell groups to changes in their environments, and as the result of a process of variation and selection of an "inter" or "intra" cellular kind.—C. J. Bond.—L. ii./11,349,391. This article should be consulted for the author's deductions, also for statements of the theories of others on cancer.

Cancer en cuirasse.—Long considered due to a malignant infiltration of the lymphatics of the skin, but W. S. Handley says it is an œdematous infiltration of the tissues due to lymphatic blocking. A paper upholding the original view.—L. ii./11,356.

Immunisation by Radium.—If a portion of mouse carcinoma be exposed to Radium for a period of time insufficient to produce a structural change, and this fragment be subsequently inoculated into other mice, the inoculation fails, no growth takes place, but the same result may be obtained by other methods, *e.g.*, breaking up the fragments in a mortar, or heating to 98.6° F. for 24 hours. In mouse carcinoma already established by inoculation exposure to Radium causes some tumours to disappear, others go on normally. Sections from the disappearing tumours show hæmorrhage where the Radium had exercised its influence, but the most noticeable change is an active proliferation of the connective tissues, especially at the margin, and an invasion of the parenchyma of the tumours by young fibroblasts. These contract on, strangle and destroy, the epithelial cells they embrace. There is no evidence of a direct specific effect on the epithelium of the growth which is found to be still actively proliferating. For details of action of Radium on the liver of a healthy mouse, *v.p. Vol I* 689. The liver cells, as with the carcinoma, undergo slight change.—L. ii./10,291.

Cancer, Credulity and Quackery.

The therapeutic value of Radium consists in its employment to treat conditions other than cancerous ones,—it has no selective effect. Surgical treatment the only way.—E. F. Bashford.—B.M.J. i./11, 1221.

Scanes Spicer says the association of **local irritations** (clay pipes, rough tooth-plates, smoking, paraffin, soot, etc.) with the starting of cancer is accepted. He draws attention to the hitherto unsuspected intrinsic irritations being even more frequent and potent causes of cancer, not only in the larynx, but throughout the body.

The sites in preference for the commencement of cancer, whether in the gullet, stomach, intestinal flexures, rectum, breast, skin, uterus, etc., are found to be those sites at which the resultant of excessive mechanical forces chronically impinge or act, and where normally there is no provision for escaping the consequences of such excess. Compare springy joints, elastic lungs, etc., with the region of the cricoid excursion,—the œsophageal gastric junction and the rectum opposite the coccyx, where various rigid resistances and soft tissues undergo relative changes of stress and position with reference to each other, with often excessive force."—L. ii./10,1830.

Chronic traumatic mastitis caused by corsets improperly made or worn. Cases are also frequently seen where the position of cancer in the breast corresponds exactly to the site of bone pressure of the stays. On the other hand, the correlation could not be definitely proved, as cases of cancer are seen in which the corsets worn would not be anatomically associated with the disease. Had never seen a case of chronic traumatic mastitis from this cause to develop into cancer and rarely a case of cancer in a breast which is also suffering from chronic mastitis from any cause. Patients should never wear anything that can act as a constant source of irritation, especially to epithelial tissue subject to such varying activity as that of the mammary gland.—G. L. Cheatle.—B.M.J. i./11,492.

Cancer, local irritants causing. Details of the causation of epithelioma by the carrying of the kangri, a portable fire basket, by natives of Kashmir; also details of pitch cancer, or fuel workers' cancer. Incidence of cancer amongst workmen engaged in making fuel briquettes.—B.M.J. ii./10,629; i./11,885.

With regard to treatment, possibility of Radium discussed, fulguration also mentioned, but without conclusion. Reduction in size of true malignant new growths in man claimed to have been effected by repeatedly inoculating human placenta and human fetal tissues. The subject of cancer carriers also discussed.—B.M.J. ii./10,1266.

Experiments with air dried cancer pulp showed the procedure is lethal to cancer cells. There is little evidence to show that cancer is an air-borne disease. Subcutaneous insertion of air-dried carcinoma produced no prophylactic immunisation to the growth of a subsequent graft, *i.e.*, that dead cancer tissue, whether killed by Radium or other means, was powerless as a prophylactic.—B.M.J. ii./10,1720.

Nature and Origin of Cancer.—Suggestion that the theory of extrinsic parasite explains the initiation of the cancer cell at the point of infection. The clinical history of the disease and successful experiment points to its extrinsic origin.—B.M.J. ii./11,1677.

Cancer a rich man's disease. The consumption of foods rich in Xanthin and Uric Acid produce gout and rheumatism and in producing them cause widespread irritation throughout the body.—B.M.J. ii./11,1678.

**Antimeristem.**—Stated to be a vaccine or Serum for the treatment of cancer. Various reports of a successful nature have appeared in German literature,—even in "hopeless cases." The preparation is based on the theory of the parasitic origin of cancer. It is employed in inoperable relapses and primary tumours, also to prevent relapses following radical operations and as diagnostic.

**Antituman**, a cancer "cure" prepared from cartilaginous tissue and arteries. It is stated to be Sodium Chondroitin-Sulphate, a salt contained in this type of tissue. Injected in doses of 0.1 Gm. It produces severe pain on injection.—B.M.J. i./10,1177.

Another worker on these lines advocates the use of an extract of these tissues.—B.M.J. ii./10,1821.

### Coley's Fluid

Is prepared by cultivating the *Streptococcus* of erysipelas in bouillon ten days. *B. prodigiosus* is added, and the two are grown together for ten days. The culture is then killed at 60° C.

In Coley's experience of 500 cases had only three deaths.

Toxin treatment of inoperable cancer entitled to more careful consideration *B. prodigiosus* has a curative effect on tumours, and intensifies the virulence of the toxins of erysipelas, hence a mixture of the toxins of this and the *streptococcus* employed.—L. ii./09,173.

The method was founded on the occurrence of retrogression in, and disappearance of, Inoperable sarcomata as a sequel to attacks of erysipelas. Six weeks to three months treatment generally sufficient. 8 minim doses thrice weekly usually employed.—B.M.J. ii./09,144.

Tumour (? sarcoma) disappeared under 23 injections of Coley's Fluid.—L. i./09,1456.

Coley recites 52 personal successes, and at least twice the number by others. Hopeless sufferers in the last stages of inoperable sarcoma show signs of improvement. Tumours steadily disappear.—Pr. Nov. '09,589. P.R.S.M. Surg Sect., Nov. '09, p.1.

The Lister Institute supplies 'New' Coley's Fluid (of red colour) in phials of 2 Cc. *Dose.*—¼ minim at first, diluted with sterile distilled water, injected into the tumour or elsewhere, gradually increased until a temperature of 102 to 104° F. is produced.

Sarcoma of the ileum treated by 5 minim injections into and round the growth two or three times a week. Disappearance of pain, gradual lessening of the swelling.—P.R.S.M. Clin. Sect. Mar. 1910, p. 114.

Coley's Fluid.—In cases of sarcoma of orbit or antrum—Oph. Jan. 1911, p. 68.

Inoperable sarcoma successfully treated with the Fluid.—Coley, M.P.C. 1911 697.

Coley points out necessity of commencing with a small dose—a quarter of a minim—and the necessity of following this up by alternate local and *systemic* injections, also injections must be given until all reaction has calmed down and the temperature fallen.—M.P.C. i./12,31.

Melanotic sarcoma of the neck treated with Coley's Fluid injected in ½ minim doses increased to 3 minims, subsequently increased to 15 minims sometimes into the growth and sometimes into the chest wall.—B.M.J. i./12 19

Vaccine Micrococcus Neoformans.—Doyen claims that cancer is associated with *M. Neoformans.* This vaccine appears to be of some use in diminishing the pain and improving the local condition in cases of advanced cancer ; the cachexia is also favourably influenced at times. Ampoules contain 25, 50 and 100 millions.

For *further methods of treatment of Cancer consult the* Therapeutic Index — *Vol.* I.

**Bacillus Coli Communis.** A normal inhabitant of the intestines, but becomes virulent in certain conditions. It increases the virulence of typhoid Dried fæcal matter is the cause of widespread distribution in the intestinal tract. The Bacillus Coli is present in an infant a few hours after birth. For further characteristics *see* B. typhosus and Bacteriological Examination of Water. Savage divides types of B. coli into groups as indicators of excretal contamination.—L. i. /05,284.

Seven cases of cystitis in children shown to be caused by invasion of this organism.—B.M.J.E. ii./04,65.

Could not be found in London air. Desiccation necessary for it to gain access to the air, which is generally fatal to this organism.—Hewlett, L. i./09, 742.

Bacilluria occurs with great frequency. 1. Associated with passage of pus: single abscess or more widespread infection of the urinary tract. 2. Milder stage — continuous passage of the bacilli but without pus or epithelial cells. 3. Intermittent passage of the bacilli. One often finds a history of constipation and a large proportion of cases are women.

In examining urine in which pus is absent one should note 1. Pale colour, paler than one would expect from the gravity. 2. Acid reaction ; often very acid. 3. The urine is hazy, not clear. Filter a little, if still cloudy, examine under the microscope : ($\frac{1}{12}$ inch oil immersion). Round bodies or short rods (the former are the bacilli 'on end'). Note mobility. Stain centrifugalised deposit by Gram's method and counterstain with Carbol Fuchsin (B. Coli is stained by the latter). The urine should be fresh and the parts cleansed before collecting sample. Inoculate an agar tube with a large loop full—note opaque white growth after 24 hours with crenated margin. B. Coli isolated from the urine used to prepare vaccine.—L. ii./09, 1269.

*Variability in the Gas-forming power* of Intestinal Bacteria. It is possible to select a strain of B. Coli which fails to produce gas from certain Mono, Di-, and Poly-Saccharides.—P. R.S.M. Path. Sectn. 1911, p. 97.

The ***typical characters*** of *B. Coli Communis* are as follows:—

1. The formation of Indol in broth culture—identified by the intense redness produced by addition of Paradimethyl-Amido-Benzaldehyde (1% solution in Absolute Alcohol and Hydrochloric Acid) and Saturated Solution of Potassium Persulphate.
2. The coagulation and acidifying of Litmus Milk.
3. The acidifying of McConkey's Fluid with gas formation
4. The reduction of neutral red to yellow fluorescence.
5. The growth of red colonies on Conradi-Drigalski's Neutral Bile Salt Agar.
6. The formation of gas in glucose gelatin 'Shake' culture at 22° C. without liquefaction of the gelatin.—B.M.J. ii./10,1133.

For *Distinction and Separation from B. Typhosus* vide *B. Typhosus.*

**Bacillus Diphtheriæ** (Klebs-Löffler Bacillus—The latest work leads to the opinion that this organism is of the nature of a Streptothrix). *Directions for collecting specimens.*—If a sterile swab is not at hand (with which is now supplied a convenient tongue depressor), a small piece of absorbent cotton wool (not medicated with an antiseptic) should be steamed, *e.g.*, at the mouth of a kettle, allowed to cool and rubbed over the membrane on the fauces of the patient and removed in a test tube or bottle which has been similarly sterilised. If possible a small portion of membrane should be detached in addition. The organism may persist for many months in nasal and aural discharges.

The organism in dry condition and in the absence of light has been shown to persist for many months, an important point to recollect in disinfection of bed linen. Moist heat destroys the organism rapidly, *e.g.*, a temperature of 60°C. Is also very sensitive to treatment by antiseptics. Nurses in charge of patients should be examined occasionally as the organism may be present without symptoms of illness and infection by such agency should be guarded against. An injection of Antitoxin is a safeguard.

**Films** are prepared from the swabbing. Stain with alkaline methylene blue or by Gram's method. Dry and mount in xylol balsam.

Recognition.—*B. diphtheriæ* may be distinguished from the other organism which will probably be seen in large numbers by the following characteristics—Irregularity in size and outline, straight or slightly curved, more or less clubbed at one or both ends (clubs chiefly in cultures), sometimes spindle shaped, or as curved wedges, occasionally irregularly segmented, rarely or never regular in outline. Parallel grouping and 'Chinese alphabet' characteristic. Stain irregularly. Show polar staining with methylene blue.—this is the best stain to demonstrate the metachromatic granules—and Gram's method, *v.p* **258.** **Cultivate on blood-serum**—fine cream-coloured growth in twelve to sixteen hours, film from the same stain with methylene blue, Neisser's or Gram's method. Cultivations should in all cases be made on blood-serum or glycerin agar before the result of diagnosis can be positive. Further characteristics,—no spores, non-motile. Form differs with culture medium.

**Neisser's original method** of staining the organism:—
Stain ½ minute each (washing between with water) with

A. Methylene blue, 0·5 Gm.
Alcohol absolute, 10 Cc.
Distilled water, 475 Cc.
Glacial acetic acid, 25 Cc.

B. Bismarck brown, 1 Gm.
Distilled water, 500 Cc.

but altered in the length of time [which was 3 seconds with A. and 10 seconds with B. (B.M.J. i./03,587) to 2 minutes each], advocated for examining direct from the swab.—B.M.J. ii./01,758.

The use of eosin solution instead of B. above gives good results, working as follows:—

1. Make film in usual manner. 2. Stain with A. three minutes, and without washing pour on Gram's iodine solution 1 minute. 3. Wash in water and counterstain with eosin 5% aqueous solution 3 minutes, wash dry and mount. This method was claimed to be diagnostic, but other organisms, *e.g.*, B. Proteus Zenkeri, B. Cyanogenus, and various organisms found in water, give similar results. The granules are stained blue, the rest of the bacillus is stained by the counterstain.

**Loeffler-Neisser method** advocated.—Stain with Loeffler's Alkaline Methylene Blue (*v.p.* **245**) 3 to 4 seconds, afterwards with B. above. Good results direct from the swab.—L. i./03,92.

Two reputed pseudo-varieties; one described by Löffler, morphologically and in all respects similar to the Klebs-Löffler organism, but non-virulent, the other by **Hofmann** shortly after the latter—stains more regularly than the Klebs-Löffler bacillus, and usually shows no polar staining.

The general trend of opinion is that the *Hofmann Bacillus* is quite distinct from the Klebs-Löffler organism but Hewlett thinks that the *Hofmann Bacillus* really includes several species of which one may be a modified Klebs-Löffler bacillus.—B.M.J. i./12,75.

*Morphology* of the bacillus varies greatly. From different individuals one may obtain (*a*) uniformly cylindrical bacilli with deeply staining round or oval terminal granules and the rod varying in length, or (*b*) very irregular in size and staining, and may be slightly curved. Further there seems to be *seasonal prevalence*: thus the *cylindrical* form, while it may prevail throughout the year appears to *predominate in winter* and *be irregular in summer.*

The importance of bacteriological investigation in the case of Klebs-Löffler Bacillus.—L. i./12,224.

**Pathogenicity of true Diphtheria Bacillus compared with pseudo forms.**

Five Cc. of a glucose-broth culture two days old with pseudo-diphtheria bacilli are not pathogenic to guinea-pigs, whereas ½ Cc. of a similar culture of true diphtheria bacilli usually kills in two days.

**Glucose Litmus Broth** cultures of true diphtheria bacilli show marked acidity in 24 hours, while those of the pseudo forms are stated not to evince this alteration of reaction. *This method is useful for confirmation where no license for inoculation of animals is held.*

**Hiss's Serum-water** modified, gives good result:—

Coagulate blood serum in an equal quantity of water, filter, add to one half 1% glucose, and to the other 1% Saccharose. Add neutral red as indicator. After 24 hours a marked acid is produced in the glucose tube by *B. diphtheriæ* in both the glucose and the saccharose tubes by *B. Xerosis* (*vide infra*) and no change is produced in either tube by Hofmann's Bacillus.—B.M.J. ii./09, 520.

*B. Paralyticans longus* and *B. paralyticans brevis* (**Muirhead's Diphtheroid Bacillus**) have been isolated and studied.—L. ii./08,1438.

**B. Xerosis** occurring in xerosis conjunctivæ also in nose, throat and ear, differs in the fact that primary cultures from the eye on blood serum first appear in 36 hours. Sub-cultures do not show this difference. The organism is non-pathogenic to guinea-pigs.

Characters. Gram + and very similar to *B. diphtheriæ*; often occurs in the throat.

**Koch-Weeks bacillus,** a thin, non-motile organism decolourised by Gram's method, is found in a large number of cases of conjunctivitis. A diplo-bacillus has also been found which causes an extremely dangerous form of conjunctivitis, but it is amenable to treatment.

**B. Morax-Axenfeld.**—Angular conjunctivitis is the only form of conjunctivitis in which the clinical appearance is characteristic of the organism at work,—the diplobacillus of Morax-Axenfeld (Gram-). Boric lotion and Zinc Sulphate 0.5% rapidly effects cure.—B.M.J. i./09.1221. A serum is not worth the trouble of preparing.—Axenfeld, B.M.J. ii./08,738.

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**Potassium Sulphocyanide Medium** for differentiation of B. Diphtheriæ and associated organisms,—Potassium Sulphocyanide 1, Calcium Chloride 1, 1% Aqueous Neutral Red Solution ½. Glucose ½, Broth 25, Sheep's Serum 75, adjusted so that on coagulation the reaction is faintly alkaline. Found of service for the routine recognition of *B. Diphtheriæ, B. Hofmanni, Torulæ, Micrococci* and *B. Subtilis* when subcultures are made direct from throat swabs on surface slopes. Colonies of B. Diphtheriæ almost invariably a bluish pink tint with diffusion of the tint through the medium.—Jl. Path. and Bact., July 1911,130. The following Media are on similar lines:—

To Sheep's Blood Serum to which has already been added 1% Glucose and 1% of ½% Solution Neutral Red indicator (this preliminary combination being denoted as "S") there is added either singly or in combination one or more of the following:—

(A). Potassium Sulphocyanide 1%. (B). Potassium Ferrocyanide 2½%. (C). Potassium Ferricyanide 1% (D). Boric Acid 1 %.

The Medium on coagulation and inspissation should be faint primrose-yellow in colour and faintly alkaline. The Sheep's Serum is best pipetted off from recently drawn clotted blood and then allowed to stand in a refrigerator for three days in order to eliminate red corpuscles by sedimentation, only the supernatant liquid being finally utilised. With combination 'S.A.' *B. Diphtheriæ* grows red with a bluish-pink tint diffusing through the medium in all directions; *B. Hofmann* grows yellow with yellowish diffusion. Some varieties of Staphylococci simulate *B. Diphtheriæ* on culture, but on further incubation the tint does not intensify as with *B. Diphtheriæ*, and should be readily distinguished; *B. Subtilis* grows brownish, *B. Megatherium* and *Torulae* grows as faint pinkish-white colonies, which are raised; *Streptococci* grows apparently colourless. Combinations 'S.A.B.' 'S.B.' and 'S.D.' in particular show up to advantage the reddening and bluish-pink diffusion brought about by *B. Diphtheriae* as compared with various *Staphylococci*. The general rule may be taken as "No red coloration no *B. Diptheriæ*." This coloration may be seen with the naked eye and hence has advantage for rapidly identifying subcultures from swabs of suspicious nose and throat cases.—B.M.J. i./11,759.

**Sections of Membrane.**—Stain for the diphtheria bacillus by Eosin-Gram-Weigert method:—

1. Stain 4 or 5 min. with eosin solution. 2. Wash well in water. 3. Pass through a little alcohol. 4. Stain with anilin-gentian-violet, 10 min. 5. Cover with Gram's iodine solution, 3 min. 6. Decolorise with anilin oil. 7. Clear with xylol and mount in xylol balsam.

Diphtheria organisms in throats of insane.—L. ii./05,465.

Diphtheroid organisms found in respiratory tracts in many cases of tabes dorsalis, but they cannot be proved to cause the tabetic toxin.—L. i./06,954.

DIPHTHERIA CARRIERS. — It does not seem to be definitely settled whether *B. Diphtheriæ*, which are typical in every way except that they are non-virulent, have any close causal relationship to cases of diphtheria or not. Very probably they are less likely to cause diphtheria in man than virulent *B. Diphtheriæ*, for the circumstances under which they regain their virulence, if they do so, are quite unknown.—B.M.J. ii./10 1508.

**Roux's Stain for Bacteria.**—Dahlia or Gentian Violet 0·5 Gm., Methyl Green 1·5 Gm., Distilled Water 200 Gm.

**Dysentery.**—*Amœba coli communis* is sometimes to be found in the stools and mucus.

**Amœbæ.** Characters of: Granular cytoplasm and vacuolated nucleus. Stain with neutral red and Licht Grün.

Three chief kinds of Amœbæ: 1. A. Buccalis, occurs in mouth, dental caries &c. 2. A. Coli.3. A. histolytica associated with tropical abscess and dysentery.

There are said to be two types of dysentery, namely, the amœbic and bacillary.

This is, however, the mixed infection, in addition, of the amœbic and bacillary. The bacillus is probably in a resting state in the human body and breaks out into activity on occasion.

Shiga's Bacillus has the characteristic of elaborating alkali in its growth, whereas Flexner's Bacillus is an acid-producing organism.

With the acid-producing organism the blood examination gives a positive Widal reaction, whereas the alkali-generating one does not. Agglutination took place in one recorded series of experiments in the first instance with a 1 in 10 dilution in two hours. The bacilli of Shiga and Flexner are non-motile non-sporing, and do not stain by Gram's method and grow on all ordinary media. In cultural characters they resemble *B. coli communis*.

A modified Shiga's Bacillus, the same in fact, excepting the reaction on neutral milk.—I. Med. Gaz., 1904, *p* 426.

**Bacillus Dysenteriæ** has been divided into four main groups, represented by:—

1. B. Dysenteriæ of Shiga and Kruse.
2. Bacillus "Y."
3. Strong's Philippine Culture.
4. Flexner's Manilla Cultures and Duval's "Baltimore" Culture.

*B. typhi abdominalis* ferments monosaccharides, mannite, maltose, and dextrin, and is distinguished from (4.) by not fermenting Saccharose, and also by its motility.—B.M.J.E. i./05,56. See also B.M.J.E. i./06,36. B.M J. i./06,908.

Shiga's Bacillus isolated in 26 cases of dysentery in S. Africa out of 55 examined. —B.M.J. i./06,680; L. i./06,904.

Epidemic sporadic dysentery traced to Shiga's Bacillus.—B.M.J. i./06,1325.

Summer diarrhœa of infants. A number of Bacilli isolated from the stools. That known as 'No. 1' having distinctive features—probably the most important factor in the disease. It is pathogenic to animals. No true Flexner type of dysentery was found. American and English differ in this respect.—B.M.J. Apl. 21,/06; B.M.J. ii./07,16.

*Morgan's Bacillus No. 1* in the normal fæces of young children,—originally found in epidemic of infantile diarrhœa. Procedure for its detection. Epidemic diarrhœa in this country caused by it.—B.M.J. i./09,1227.

Flies as carriers of micro-organisms resulting in infantile dysentry. Muslin to be kept stretched over the child's milk.—L. ii./08,715.

The two varieties of Shiga and Flexner certainly account for the dysentery of Japan, China, the Philippines and the West Indies. One or other occasionally appears in temperate countries. Hiss and Russell and a third type which differs only in fermenting mannite. A fourth (by Wollstein) ferments saccharose, mannite and dextrin. A fifth, as added by Shiga. B. Dysenteriæ is difficult to isolate.—B.M.J. i./09,768.

At least seven different dysenteries to deal with at El Tor among Mussulman pilgrims.—B.M.J. ii./09 862.

DYSENTERY CARRIERS.—Healthy carriers are very rare and of no importance. Actual carriers are to be found among the incomplete convalescents which form a high percentage of the cases. In combatting an epidemic it is necessary to reduce as far as possible the number of such cases and to isolate very strictly those that are already of this type.—B.M.J. ii./10,1507.

**Bacillus Equi.**—Pathogenic for rodents. In horse blood.—Klein, L.i./06, 782.

**Filaria.**—In *Filaria sanguinis hominis*, or elephantiasis, there are two kinds of worms, nocturnal and diurnal, which only appear in the blood immediately below the skin at night and day respectively, and the mosquitoes, in which the cycle of the parasite's existence is completed, only bite during these respective periods. An effective treatment, therefore, is to alter the patient's sleeping period—*e.g.*, by keeping him awake at night.—Cantlie. The parasite is acquired by drinking infected and polluted water. In some countries a very large proportion of the population have the embryos of *Filaria nocturna* floating in their blood. Elephantiasis in all its phases is very marked in these localities. The worm is introduced under the skin in early stages by the proboscis of a type of *Culex*.

The female adult worm was discovered by Bancroft, the male by Aranjo, and the embryo by Demarquay and Lewis. The embryos inhabit the lymph channels of the lower extremities and the scrotum. They lead to dilatation of the lymphatics, to hyperplasia of the tissues, chyluria, hæmaturia, abscesses, &c. They are found in the blood at night.—Gould.

Eosinophilia in filarial disease. The eosinophile cells accumulate round the encapsuled fluke.—L. i./06,1623.

A tick, *Ornithodoros Moubata* (Murray) is probably the intermediate host of Filaria.—B.M.J. i./07,143.

Prospective cure for elephantiasis by introducing silk threads into the limbs to replace the trunk lymphatics, and thus remove fluid from the œdematous part.—L. i./09,31.

Palliative treatment by Thiosinamin, combined with constant pressure by bandaging. Without the latter Thiosinamin has no effect whatever.— B.M.J. ii./08,1361.

**Micrococcus Gonorrhœæ.**—Stain specimen firstly by Gram's method, afterwards with carbol-methylene blue or alkaline methylene blue 3 to 5 minutes, wash in water, dry and mount.

RECOGNITION:

A medium sized diplococcus; reniform in shape, intracellular character, thought to be of no value in differential diagnosis, though previously stated to be so, but *vide* M. and R. The organism is Gram negative.

*Culture.*—Blood agar; difficult to grow; slow growth, small discrete "dew drops."

May also be grown on **Nasgar medium** (Nutrose-Ascitic Agar).— This is prepared as follows: (A). Ascitic Fluid 15 Cc. Distilled Water

35 Cc., Nutrose 1 Gm. Shake well in a flask, boil slowly 30 minutes preventing burning. Nutrose prevents Ascitic Fluid from coagulating. (B.) Agar 3 Gm., Peptone (Witte) 1 Gm., Sodium Chloride 0.5 Gm., Meat Extract to 100 Cc.

Add 1 part (A) to (B) two parts, cool to 60° C., add the beaten whites of two eggs (for 1 litre). Heat in flask in autoclave to 115° C. for 45 minutes, or in a steamer for 90 minutes. Filter, placing the funnel in a warm water-jacket. Put in tubes and heat in the steamer for 30 minutes on two successive days. —Abel and Gordon's Bacteriology, page 147.

**Milk Broth or Milk Agar for cultivation of Gonococcus.** Fresh Milk 1,000 Cc. is mixed with 5 Cc. of 1 in 4 Hydrochloric Acid and kept at 37° C. for 16 to 20 hours to precipitate Casein, or the milk can be boiled, filtered and the filtrate neutralised with 10% Sodium Hydrate—then place in autoclave 2 hours, boil, neutralise again and filter. The filtrate is mixed with equal parts of broth, or one or two parts of 'Agar.' Put into test tubes and sterilise.—J. E. R. McDonagh, Pr., Nov./10.

**Pappenheim's Stain.** *Syn.* **Unna's Stain.**—Concentrated Aqueous Pyronin Solution 1, Concentrated Methyl Green Solution 3, is useful. Stain 5 minutes, wash and dry. Gonococci stain red, cells, etc., blue.

Wyatt Wingrave's Modification = Pyronin (water soluble) 2, Methyl Green 3, Distilled Water 100. Dissolve separately, mix and filter. After staining, wash with water and differentiate with 5% Resorcin in Alcohol.

All organisms by this method, especially the Gonococci, stain a brilliant red and pus cells greenish-blue. The Gonococci are found in regular clumps of Diplococci, the distance between each pair being much the same. Some are intracellular.

The diplococcus can usually be readily found in large numbers in discharges of gonorrheal origin, but a diplococcus of similar appearance is also apparently to be found not infrequently in vaginal discharge of non-gonococcal origin. If a distinction is to be made it is best to try to grow the organism in question on the ordinary forms of culture media, as, while the gonococcus will not grow on plain agar, it grows freely on blood agar. On the other hand, the other forms of diplococcus met with in the vagina usually grow freely on plain agar. It is also possible that the presence of the diplococcus inside the pus cell is characteristic of the gonococcus, but one must be a trained microscopist, who is continually examining such preparations, to be certain that what appears to be inside the cell is not really lying directly below or above it. Therefore, in cases in which a diagnosis is of serious importance, it should never be based on a mere clinical examination.—J. E. R. McDonagh, Pr. Nov. '10.

**Acid Thionin.**—Thionin 0.5%, Glacial Acetic Acid 5% in Distilled Water. Stain 3 minutes, wash in tap water. A very reliable stain,—shows phagocytosis well and the characteristic " kidney " shape of the Cocci. Best stain for general use when confirmed by 'Gram.'—Wyatt Wingrave.

**Jenner's Stain**, *q.v.*, also gives excellent results.

A case should not be diagnosed as positive from the presence alone of extracellular diplococci, as the extracellular life of the gonococcus is short, and even in a Gram negative examination, one cannot be always sure as to whether they are gonococci or no. The intracellular life is peculiar to the gonococcus, as it increases in the cell, without any apparent detriment to that cell, instead of being eaten up by the cell, as is usual, in other words, it becomes a " saprophyte."—Pr. Apl. /09,534

**Schutz's Stain** is recommended for diagnosis in the 'Treatment of Venereal Disease and Scabies in the Army'—Advisory Board for Army Medical Services publication, 1904, p. 39—*i.e.*, staining with a saturated solution of Methylene Blue in 5% Phenol for 5 to 10 minutes, then washing in water, next dipping in a solution of 5 drops of 'Acetic Acid' (? strength) in water 20 Cc. for 3 seconds, and finally washing. All organisms are stated to be decolorised except gonococci—we do not think this would be diagnostic—further confirmatory stain necessary, **Acid Thionin**, *vide* above, is quicker and more reliable.

**Other Diplococci** :—*D. albicans amplus* Bumm, found in mucus in the healthy vagina : *D. albicans tardissimus* morph. identical with the *Gonococcus* *D. Coryzæ*, *D. intracellularis Meningitidis* (**v.** Cerebro-spinal Fever), *D.* o. *orchitis* found in gonorrhœal pus during the first two days—pathogenic). *D* *pneumoniæ, syn. pneumococcus* of *Frankel, q.v., D. pyogenes ureæ,* and *D. Catarrhalis.* vide *M. Catarrhalis.*

N.B.—*Pneumococcus* is the only Gram + Diplococcus. Capsule well marked in pus, but not in culture. Cocci, elongated or lanceolate, converts oxy- into methæmoglobin in the culture. Will not grow on Gelatin.

**Bacillus Influenzæ,** Pfeiffer's Bacillus. A very small bacillus, non-motile. Does not stain by Gram's method, nor grow on ordinary media unless albumen be present. Grows best on blood agar, but dies out rapidly unless sub-cultured every few days. Present in sputum in cases of influenza. Stained by methylene blue the bacilli are very numerous in masses, but never seen in chains.

The *bacillus* is thought to play an important part not only in acute exacerbations of middle-ear suppuration, but also in primary attacks, an association first demonstrated by Pfeiffer himself. Owing to its feeble staining reaction it is easily overlooked, but if specially stained it is readily seen in acute cases of aural diseases, especially those complicated by osteomyelitis.—Wingrave, M.P Sept. 23/03,343.

Post-Influenzal arthritis. Pyæmia due to this organism.—L. ii /07,685.

A number of cases of broncho-pneumonia occurring in one family. The influenza bacillus, the only organism found—in the lung of one of the children—the apparent cause of death in all.—L. ii./09,1661.

In an epidemic in America of so-called influenza, the pneumococcus was always present, the influenza bacillus in very few cases. The pneumococcus is predominant in the acute stage. Though the influenza bacillus is often found in so-called influenzal pneumonia it is not the primary cause. A mixed flora in the secretions in these cases is characteristic. Influenza bacilli are commonly found in the throat in pertussis, measles, pulmonary tuberculosis. Not found in any of 11 cases of acute articular rheumatism.—B.M.J.E. ii./08,81 ; *c.f. Vol. I*, p. 896. and **219.**

*Morphology and Culture.*—In 1889-91 Pfeiffer described a bacillus which was accepted as the causal agent of influenza. It is usually solitary, but it also occurs in chains of three or four. It grows best on media containing hæmoglobin or blood, as stated above, but can also be cultivated on Glycerin Agar-Agar.—L. ii./10,1289, *q.v.*, for further details, *vide* also our *Vol. I* p. 887.

**Johne's Disease** in cattle (previously thought to be due to coccidia) has been identified with Johne's Bacillus—which is distinct from Tubercle Bacillus. F. W. Twort has grown the organism on the special culture medium used by him for isolating Leprosy Bacillus, *q.v.* Injections in guinea-pigs, rabbits, etc., produced negative results. Vaccines for the diagnosis of Johne's disease in cattle as distinct from tuberculosis may possibly be made. Communication to Roy. Soc. of Medicine, Nov. 1, 1910 ; Na. Nov. 24/10,127.

**Kala Azar,** Dum Dum Fever—characterised by persistent fever of alternating and intermittent type—certainly caused by a minute organism, which has been shown to be a stage of a flagellated parasite.—Leishmann. - Donovan bodies, intracellular, probably a trypanosome.—L. i./07,186. Its differentiation and epidemiology.—L. i./07,643. This disease is transmitted by the bed bug.

Leishman-Donovan Parasites classified in a sub-order of the flagellata along with or near the genera Herpetomonas and Crithidia.—Consult Allbutt.

In addition to the irregular fever there is progressive enlargement of the spleen, progressive wasting, swelling of feet and legs, diarrhœa simulating dysentery, and enlargement of the liver. It is almost invariably fatal.—I.M.G. Jan. 10 1907.

Is but a malicious type of malaria.—Ghosh.

Good results have been obtained by injecting 20 to 90 minims of a solution made of Quinine Sulphate 32 grains, Dilute Sulphuric Acid 1 drachm, Distilled Water 4 drachms. Five minims of 2% Cocaine Solution is first injected ; the needle is left inserted, the syringe withdrawn from it, the solution drawn up into it and injected after a couple of minutes into exactly the same place where the cocaine solution was injected. A certain amount of painless effusion is caused. Injections have to be repeated just before the effusion from the first injection has disappeared.—Pres. June, 1911.

In Madras especially in regard to its connection with the dog and the bug.—L. ii./09,1195.

Oriental Sore.—Differences between this and Kala-Azar.—B.M.J. ii./09,647, 1333.

Curative value of Leishmania Culture ' Vaccine.'—B.M.J. i./12,540.

Atoxyl used in a case with some improvement, but ultimately fatal ending.—B.M.J. ii./09,1614.

*Leishmania Donovani and L. Tropica.*—B.M.J. i./12,717. Transmission by bugs *v.* also B.M.J. i./12,567, and L. i./12,743.

**Ponos**, a disease occurring in two Greek islands, is apparently the same as Kala-Azar. The finding of the Leishman-Donovan body in splenic or hepatic puncture remains wanting to establish the identity of the two.—B.M.J.ii./09, 782

## Leprosy.

The presence of *B. leprae* (**Hansen's Bacillus**).—The specific organism of Leprosy in the mosquito (*Culex pungens*) and in the bed bug (*Cimex lectularia* was shown.—L. i./06,1347.

Bacteriology and pathological anatomy of leprosy. Possible association of leprosy with other diseases, *e.g.*, tuberculosis in the same individual at the same time.—J.M.H.McLeod.—L. ii./09,515.

From three cases of nodular leprosy an acid-fast bacillus isolated which by subculture through successive generations gave a pure growth possessing "certain peculiar characteristics resembling morphologically the bacillus of leprosy." The culture medium consisted of 250 Cc. of distilled volatile alkaloid of rotten fish, 250 Cc. of weak "Lemco" broth without salt or peptone, and 50 Cc. of milk. "After three days inoculation the culture of acid-fast bacteria was subcultured on nutrient agar and broth (without salt or peptone); a feebly acid-fast bacillus developed. Its acid-fastness was increased by growing in milk, the degree varying according to the fatty nature of the medium. Agar plate cultures were made and these, three days after inoculation showed discrete colonies about the size of a pin's head, opaque, orange-red, raised in the centre, humped and moist to the naked eye. After 48 hours' growth its appearance is as in the nodules of a leper. The cultures when tested on guinea pigs, white rats and rabbits, gave negative results. A monkey, after repeated injections with culture developed clinical signs of the disease, and showed nodules in which were found typical leprosy bacilli, but attempts to obtain a pure culture from the lesions proved unsuccessful. Ten cases of leprosy were tested with Vaccines prepared from these cultures " two have now recovered; two are so much improved that apparently the remnants of the disease are very slight, and the remaining six have all improved in a remarkable manner."—E. R. Rost, I.M. S.—B.M.J. i./11,184.

Captain Williams has grown from cases of leprosy **four types of organisms** which are thought to be four phases of pleomorphic streptothrix,—an *acid-fast* and a *non-acid-fast bacillus* and an *acid-fast and non-acid-fast streptothrix.* It seems that the acid-fast streptothrix form can be converted into a non-acid-fast bacillus by change in the cultural environments. The four different types may be regarded as four different phases of the *same micro-organism.* He further describes a Vaccine prepared from cultures of the Acid-fast Streptothrix for which he claims immunising and possibly curative properties. — B.M.J. ii./11,184; L ii./11,109; see also B.M.J. /12,300,392; L. i./12,741

Leprosy is possibly conveyed by the bed bug, but the fish hypothesis ' is supported by Sir J. Hutchinson. The disease does not spread in the neighbourhood of leper establishments.—B.M.J. ii./11,463.

Some interesting experiments to determine mode of transmission of leprosy show that flies, mosquitoes and other insects may spread it but in particular *Acanthia lectularia* appears to constitute a very important agent in the spread. Acid-fast bacilli resembling *B. leprae* have been found in 30% of specimens up to 16 days after feeding on lepers.—T. Lindsay Sandes.—B.M.J. ii./11,469.

Bed bugs obtained from huts which had never been inhabited by lepers were caused to bite lepers near leprous nodules on the face,—in every case they contained the bacilli. Experiments to determine how long they remain in the bug's body, etc., in progress.—E. C. Long.—B.M.J. ii./11,470

Love of the leper for fish diet generally in a state of decomposition.—B.M.J ./11,1234.

Leprosy can under certain circumstances be transmitted to animals.—B.M.J. i./12,424.

A thorough disinfection of the nose is one of the first essentials in treatment. A solution of **Ammonium Persulphate** 3.7% and Hydrochloric Acid 1% in water has been used. Inhalation of the fumes of **burning sulphur** has also been employed.

A recently issued Parliamentary Paper (January 1912) reports on trials of Nastin (*vide* previous Edition) and **Benzoyl Chloride** in treatment of leprosy at the Mahaica Leper Asylum, British Guiana. Nastin has very little beneficial effect. Benzoyl Chloride in Petroleum Oil is extremely valuable as a nasal spray or paint to ulcerating surfaces.—its regular use for such purposes is strongly advised. Opinion as to Nastin was not so favourable.

**Bacillus Lepræ** has morphology similar to *B. tuberculosis*, but usually occurs more in clumps and are said to be tapered at the ends. Stain irregularly, and are more readily decolourised than *B. tuberculosis* by inorganic acids. Gram +.

FURTHER NOTES ON ISOLATION AND CULTURE.—Leprosy material from a typical leper was placed in 2% Ericolin Solution to kill contaminating micro-organisms and then inoculated on the following tubercle medium:—Egg 3 parts, 0.8% Sodium Chloride 1 part, ground Tubercle Bacilli 1% and Glycerin 5% or less, mixed, placed in tubes, sterilised and set in slopes. On this the Lepra Bacillus grew very slowly as a delicate colourless streak along the inoculated track and showed the typical morphological and staining characters of the Lepra Bacillus; the Bacillus could be subcultured only on the Tubercle Medium.—F. W. Twort, P.R.S.M. Nov 1, 1910 ; B.M.J. ii./10,1919 Na. Nov. 24/10,127.

A general review of the drugs used in leprosy. Chaulmoogra Oil affects the disease favourably, but it is not a cure. "X" Rays useful, but they have their limitations. Clegg working independently at Manilla has succeeded in cultivating an acid-fast bacillus from the spleen and nodules on the ear of leper patients. He prepared a Vaccine, also a Glycerin Extract and Soap Solution. Treatment by these means was tried upon a number of lepers during a period of over 12 months, but in no case with any perceptible benefit. The Glycerin Extract had no action on the skin of leprous or normal persons. A remedy for leprosy is still wanted.—L. i./11,1523, *c.f.* F. W. Twort's work, above.

It is possible that the Hansen's bacillus is merely a harmless accompaniment of the real organism. It is possible to culture from cases of human leprosy an acid-resisting diphtheroid organism which acquires acid-fast properties on being injected into rats or mice.

Besides the culture of an acid-fast or other organism, complete animal experiments and extensive serological tests are necessary before a statement as to its relationship to the disease can be made. Mice or rats injected with a culture of acid-fast diphtheroid bacilli originally obtained from acid resisting diphtheroid organisms of human leprosy, are capable of giving a culture of an acid-fast rod-shaped bacterium which when injected into other rats gives rise to what appears analogous to genuine spontaneous rat leprosy. The most favourable medium for growth appears to be either Placental-Extract-Agar or Horse Serum-Nutrose-Agar with the addition of 2% ground-up *Smegma Bacilli*. The author confirms *Kedrowsky's* work on the variable morphology and staining properties of the *Lepra Bacillus*. Agglutination, precipitation, complement-deviation and percutaneous tests can be used to prove the relationship of acid-fast or other germs cultured from cases of leprosy. Rat and human leprosy appear to be identical diseases. It is therefore possible that the germ of both can be transmitted from one to the other given an appropriate intermediary.—Bayon, B.M.J. ii./11 1269 ; L. ii./11 460.

**Malarial Parasites.**—The mosquito theory of this disease was established by Ronald Ross, the winner of the 1902 Nobel prize; after Manson, Golgi, and others had paved the way to a great extent. The *Culex pipiens* or common mosquito it is thought does not convey malaria. It is the Spot-wing or *Anopheles maculipennis*, also belonging to the *Culicidæ*, which carries infection.

(No fewer than 82 genera of the *Culicidæ* are now described.—Allbutt's System of Medicine.)

The female Culex has the palp much shorter than the proboscis, whereas that of the female Anopheles is almost the same length as the proboscis. The body of the Anopheles stands at an angle with the surface on which it is resting, whereas the body of Culex is almost always parallel with it.

The female is frequently found with its body 'blown out' with blood which it has imbibed. This Anopheles is common throughout the world. The males are harmless as far as blood sucking is concerned. The Midges (Chironomidæ) which dance and 'swarm' in the evenings are quite harmless. Important differences in venation and hairs on the wings enable one to distinguish between Culicidæ and Chironomidæ with certainty. The Anopheles goes through the stages of ovum, larva, and pupa ; the mosquito lives in the water.

Laveran, the discoverer of the parasite of malaria which is known as *Hæmamœba*, previously called *Plasmodium* or *Hæmatozoon malariæ*, divided it into the following phases :—1, spherical bodies ; 2, flagellated ; 3, crescents ; 4, rosette forms.

(Some observers, contrary to Laveran, have been of opinion that the different types of malaria are due to different species of the organism.)

The whole life history of the Plasmodium will be found illustrated by some excellent models at the Natural History Museum, South Kensington, London. Briefly in the tertian form the spore, which is freely swimming in the blood plasma enters the corpuscle. It develops amœboid movement and then shows pigmentation owing to changes in the hæmoglobin. A nucleus is developed The rosette form is the next change owing to division of the Karyosomes On breaking up, the spores are liberated into the blood, the spore emission being synchronous with the attacks of renewed fever.

There are two distinct cycles of existence, one in the human being (asexual) and the other (sexual) in the mosquito.

Furthermore, there are at least three distinct species of the parasite infecting man :—

(i) **Quartan.**—This completes its cycle in about 72 hours—there is pyrexia every third day ; double or triple infection may, however, occur. In the case of this species only the smaller forms show movement (which is not pronounced as in the **Tertian**). The pigment granules are coarse and almost black in colour. The rosette contains 6 to 12 spores, and the red corpuscles retain their colour and size.

(ii) **Mild or Benign Tertian.**—The parasite matures in 48 hours, though by double infection a quotidian form may be produced. The outline of the amœbulæ is less refractive than in the Quartan. Movement is much more active. **Schüffner's Dots** may be observed on staining, in the infected corpuscles. The rosette is somewhat larger than in the Quartan, and gives 15 to 20 somewhat oval spores.

In addition there is the **Æstivo-Autumnal** or '**Malignant**' or **Tropical Malaria** parasite. The cycle of change is difficult to follow, it probably occupies 48 hours ; the young parasites are very small but active, which, however, change into the resting 'ring-forms.' Pigment granules are small and few in number. The fully developed sporocyte occupies less than ½ the red corpuscle, and yields usually 6 to 12 spores—irregular and minute. Sporulation occurs internally, hence sporocyctes not seen as with (i) and (ii) in the peripheral blood. "Crescent" forms are seen, but they do not appear in the blood until several days after the onset of the fever. They are extremely resistant to quinine. These crescents are the male and female gametes ; it is possible to observe the male changing into spherical bodies which will flagellate whilst the others will not. The gametes are not crescent-shaped in the other forms of malaria.

For quinine treatment, *v. Vol. I.* 615, 650, and 838, *et seq.*

## *Staining Methods.*

Films of blood smeared evenly with a very small quantity *s.a.*, dried in the air not by aid of a flame, and fixed by immersing in alcohol and ether, equal parts, 10 minutes, may be stained with aqueous methylene blue and eosin, or wit methylene blue alone, 5 minutes, or with a Hæmatoxylin Stain, or by **Leishman's Stain** (*q.v.*). With Leishman's Stain fixing is not necessary. **Muir** says th structure of the parasites is well brought out by the following :—Soak film i Saturated Corrosive Sublimate Solution a few seconds. Wash well, stain wit hæmalum 10 minutes, wash, stain again for about the same time with aqueou methylene blue. Wash in water, dehydrate, clear in Xylol and mount in balsam he chromatin of the parasites is violet blue, and the protoplasm pure blue. Th

Leishman method is, however, principally in use. Consult Allbutt's *System of Medicine*, or M. & R.

**Malaria—rapid method of Diagnosis.**
Thick Films are examined—the thicker part first before even dry—the diffuse and fine dots of tertian, the compact and coarse dots of quartan and the peculiar arrangement of the pigments in the crescent in tropical malaria are very characteristic—not to mention pigmented leucocytes, be sure the pigment is on the same level as the red corpuscles and disappears totally on focussing up and down.—J. Cropper, B.M.J. i./12,890.

Two mosquitoes *Pyretophorus costalis* and *Myzomyia funesta* responsible for the spread of, in Madagascar.—B.M.J. ii./06,1056.

Panama, the most difficult place to rid of the scourge, nevertheless *Anopheles* and *Stegomyia* practically abolished from the Canal zone.—B.M.J. i./07,401.

Unsolved problems and troublesome symptoms in malaria.—B.M.J. i./07,687.

Sir P. Manson has prepared a table of tropical diseases, showing their germ causes and intermediaries. A lecture dealing with the subject, tropical temperature is necessary for the growth of the intermediary.—L. ii./08,891.

Steps to be taken in Malarial districts, treatment of watercourses, houses, &c.—B.M.J. ii./07,1041 *et seq.* See also *Vol. I* p. 888. for further details.

**Peritonitis,** Bacteriology of. Frequent presence of a *Staphylococcus albus.*—L. i./06,1250.

## Bacillus Pestis (Bacillus of Bubonic Plague).

*Vide* also Vaccine chapter for recent work, *Vol. I.* 891.

Specimens from the buboes show coccus-like forms. They were first found by Kitasato in 1894.—L. ii./98,428.

Culture—Yersin first described the cultural properties.

Morphology.—Short fat bacillus. On staining with weak aniline dye shows marked polar staining. Spores have not been demonstrated. Non-motile. Does not retain the stain when treated by Gram's method; grows well on usual media (? potato) both at room and body temperature. Does not liquefy gelatin. Occurs in chains when grown in fluid media. Forms typical stalactite growths in bouillon and in presence of butter fat, but must be kept undisturbed (Haffkine). Man is inoculated through the broken skin.

Recent work on the Bacillus.—B.M.J. ii./05,735.—B.M.J. i./07,691.

The bacillus produces alkali in its growth, which ultimately causes stoppage of its growth (in broth). The amount of alkali produced is equivalent to 1·5 to 2·5% normal Sodium Hydroxide (solution presumably), and this amount, reached in 6 to 8 weeks, causes arrest of the growth, but not death of the bacillus.—L.ii/08,1620.

In smears made at an early stage of the disease from the buboes, expectoration or blood respectively in the three varieties of plague, the bacillus is present in enormous numbers, and the films show "polar staining," the centre being hardly stained at all; this is characteristic. In older lesions peculiar, large, rounded or ovoid "involution" forms of the bacillus are met with. The organism is readily destroyed by heat (60° to 65° C. for ten to fifteen minutes), and by disinfectants. The plague bacillus is pathogenic for a number of animals, in addition to man—the rat, mouse, guinea-pig, rabbit, hare, ferret, cat, monkey etc. In the United States the ground squirrels are attacked.—R. T. Hewlett Na. Dec. 22, 1910, p. 237.

## Pneumonia.

**Fraenkel's Pneumococcus.**—1. Prepare films from 'rusty' portion of sputum. 2. Stain by Gram's method and counterstain with eosin half to one minute. Stain other films by carbol-fuchsin. Overstain (five minutes). Slightly decolourise with weak acetic acid. (For capsule.)

To obtain a pure culture, the blood of a mouse dead from inoculation of sputum is sown on blood agar or Nasgar medium. Will not grow below 37° C.

Recognition.—Diplococcus (free ends are often pointed—*Diplo lanceolatus*) sometimes occurs in short chains of four to ten cocci. Has a capsule. Stains by Gram's method.

Pneumococcic peritonitis in children, 15 cases reported.—L. i./06,1591.

Macfadyen on the Pneumotoxin.—B.M.J. i./06,776.

In an epidemic of influenza swabbings from the fauces frequently showed pneumococci in addition to Pfeiffer's Bacillus and Strepto and Staphylococci. In uch cases (which invariably developed into pneumonia) it was considered that the influenza bacillus first weakened the resisting power of the lung and if pneumococci were present they invaded the weakened lung and produced pneumonia; where the pneumococci were associated with staphylo- and streptococci a mixed infection and much more severe case resulted.—Pres. July, /o8,131. *Vide* also Vol. I. p. 895 and **215**.

CONJUNCTIVITIS, BACTERIOLOGY OF.—In a school outbreak an organism morphologically identical with the pneumococcus but differing in fermentative activity and its non-pathogenicity to animals, usually highly susceptible.—L. ii./II,1418.

**Friedländer's Pneumobacillus.**—Present in only small proportion of cases of pneumonia. Not stained by Gram's method, but well by carbol fuchsin.

Recognition.—A bacillus varying considerably in length; usually short, with rounded ends. Has a capsule. Is easily cultivated on all ordinary media.

Characters.—Best examined by dark ground or parabolic illumination. Gram—Stain by Gram's method but do not wash with alcohol, and omit any counterstain. Hot Carbol-Fuchsin gives good results.

**Bacillus proteus vulgaris** occurs frequently (50% of examinations) in chronic aural discharges. Like the colon bacillus, it stains with difficulty unless previously treated with iodine or pot. permanganate. It is Gram — and about 3 μ in length, but may grow into long leptothricial threads. It is nearly always associated with fœtor, and has the reputation of being a powerful ptomaine producer.—M.P. Sept. 23,/o8.

**Relapsing Fever** is associated with the presence of **Spirochæta Obermeieri** in the blood. In cases of relapsing fever terminating fatally the blood is frequently found to be teeming with the organisms. The corpuscles with the $\frac{1}{12}$ inch oil immersion lens frequently appear to have slender spiral filaments attached to them, causing a rippling movement of the blood, which persists for several hours when examined in the fresh condition.

This Spirochete has, as yet, not been cultivated, but it is suggested as a stage in the life history of the trypanosoma, and hence does not belong to the vegetable kingdom. Trypanosomes have been successfully cultivated in a condensation fluids which arises from a special medium prepared from defibrinated rabbit's blood and agar-agar; there may be hopes of growing Spirochæta on a similar medium.

Assumed spread of infection through mosquitoes.—B.M.J.i./o6,1400.

Spirochetes often occur in suppuration of middle ear (Wyatt Wingrave, Roy. Soc. Med. 1908) also in mouth and nose. *Synonyms*: *Sp. Refringens*, *Sp. dentium*, *Sp. buccolis*, *Sp. foetida*, *&c.* They are generally associated with *B. fusiformis*. Variable in size and shape, strongly resemble *Sp. Obermeieri*. Attended by striking fœtor.—M.P., Sept. 23/o8, p. 312. *See also* Tick Fever, p. **239**.

**Ringworm Fungi.** Rapid Clinical Method of Search:—

(1) Soak the hairs in Potash Solution 10 minutes.
(2) Wash in water to free from alkali.
(3) Mount in Glycerin or Glycerin Jelly.
(4) Ring with gold size.

*For permanent stained sections:*—

(1) Soak the hairs in Potash Solution 10 minutes.
(2) Stain with Anilin Gentian Violet (*q.v.*) for 1 hour. (Malcolm Morri formula: 5% Alcoholic Gentian Violet 1, Anilin Water 3.
(3) Absorb excess of stain.
(4) Treat with Gram's Iodine Solution 2 minutes, wash in water Decolourise with acidified Anilin Oil (Anilin Oil 10, Nitric Acid 1) fo 15 to 20 minutes. Treat with Anilin Oil 1 minute, clarify in Xylol and mount in Balsam.

The organism of *Favus* is *Achorion Schönleinii* those of *Tinea tonsuran* (RINGWORM OF THE SCALP) and *T. circinata* (RINGWORM OF THE BODY *i.e.*, non-hairy skin, are *Microsporon Audouini*, *Tricophyton Megalosporon ect thrix*, and *endothrix* (according as the fungus lies outside or inside the hair), tha of *Tinea* (*Pityriasis*) *versicolor* is *Microsporon Furfur*.

Ringworm of the Scalp is rare in the adult.

*Tinea Barbæ* or *Hyphogenic Sycosis* (Ringworm of the beard) is a commo affection of the beard. The common grey coccus inhabiting the upper laye of the epidermis may cause an infection and cause pustulation, but the fungu can be distinguished from this coccigenic variety. Syphilis may also sometim simulate ringworm of the beard. *Eczema Marginatum* is a name for ringwor attacking the groins and axillæ. *Onychomycosis* or ringworm attacking the nails only—not common, but very troublesome.—For a useful clinical lecture on the subject *v.* M.P. Sept. 5, 1906.

Cultivation of Ringworm Fungi is possible on all ordinary media, but the addition of Glucose or Maltose is most favourable.

Nail ringworm and a case infected by washing of stockings, also one caused by mouse bite.—L. ii./08,238.

270 Ringworm patches in school children treated by X-rays. With exception of 5 cases, all were due to *Macrosporon Audouini*. 3 were due to *Megalosporon endothrix*, and the other 2 to *Tricophyton ectothrix*.—B.M.J. ii./09,454.

Suggested study of the question as to whether pediculi capitis are not carriers of ringworm infection,—thought to be so.—B.M.J. ii. 11.780.

**Seborrhœa.**—Sabouraud isolated a microbacillus whose favourite habitat is the upper portion of the hair follicle,—this causes the output of increased amount of sebum.—M.P. June 8, 1904, p. 618.

### Scarlatina or Scarlet Fever.

Kerr on the Bacteriology of Scarlet Fever: It is proved that the infecting agent is present in the pharyngeal and faucial mucus. Examination of the Streptococci. L. i./08,995. It is probable they are a secondary infection—the exact cause unknown.—L. i./08,1024.

**Streptococcus Conglomeratus Vaccine** is prepared, but so far has not been subjected to a very considerable trial.

In most cases, with or without albuminuria, *Streptococci* are voided by the urine in large quantities in this fever.

### Serpent Venom. Anti-venene.

In the preparation of this serum the venom is removed either from the living snake or after killing it. This venom is mostly desiccated over sulphuric acid *in vacuo* and a weighed quantity of this is dissolved in sterile water and injected into the horse. The increase in dose proceeds very gradually; the final dose appears to be about 0·6 Gm. of venom, equivalent to the entire yield of 20 average sized snakes. The serum is removed in the customary manner and standardised.

Calmette showed that the venom of all snakes is of a similar nature, and obtained his remedy by the inoculation of horses with the poison of the cobra di capello; his serum possesses a strength of 1 in 20,000; that is to say $\frac{1}{10}$ Cc. subcutaneously injected into a hare of two kilos in weight suffices to protect it from snake poison which kills a similar hare in eight hours.

It is claimed that anti-venomous sera are specific even between the venoms of a species of the same genus. An account of the serum therapeutics of number of cases. L. ii./04,1273. *Vide* also L. i./06,1231

Calmette has described the hæmolysins of snake poison; in addition to these bodies snake poison contains neurotoxins, which act on the nervous system, and cytolysins dissolving other tissue elements.—Bull. de l' Inst. Pasteur 'T,' *c.p.* 193.

*Dose.*—Anti-venene is supplied in tubes of 10 Cc. This amount or as much as 40 Cc. should be injected. The serum should be as fresh as possible. (As much as 400 Cc. intravenously and 10 or 20 times that amount, if subcutaneously, for cobra poisoning.—L. ii. 04,1273.) The injection requires to be made at once, or within an hour in man; death seldom occurs from serpent poison under three hours.

The dose of venom injected by a healthy cobra is about ten times as much as was assumed by Calmette, therefore the dose required to neutralise the poison should be ten times as much as that recommended by Calmette and Lamb.—Ghosh.

A ligature must be bound above the bite if possible. The wound should be opened up and washed with Chromic Acid or Gold Chloride 1% solution.

**Skin, Tropical Diseases of.**—MacLeod, B.M.J. ii./05,1266.

PINTA, a disease caused by a fungus, producing discolourations on uncovered parts of the skin.—B.M.J. ii./05,1270.

PITYRIASIS VERSICOLOR, due to fungus growth under the skin, common in the tropics.—B.M.J. ii./05.1271.

PELLAGRA.—One of the chief plagues in Italy. *Aspergillus fumigatus* and *flavescens* said to be the cause. Some say it is hereditary.—B.M.J. ii./05,1273.

Pellagra is found in Europe, Africa, Asia, America, and even in Oceania, and probably affects more or less seriously over a million people. It is a disease of long duration, characterised by a peculiar rash, not unlike a severe sunburn which appears on the face, round the neck, and on the back of the hands and feet. This eruption recurs each year at determinate seasons (spring and autumn); it appears suddenly under the influence of exposure to sunlight stands out some days, then fades off gradually, and is followed by long persistent desquamation. Together with the eruption other symptoms appear. They are irregular fever, frequent fits of giddiness with a peculiar sensation of falling backwards or forwards, great debility, confusion of mind, copious salivation, insomnia, pyrosis, and diarrhœa. These symptoms abate during the summer months and disappear almost entirely in winter, especially in early cases. They return with the rash each spring. After a period of progressive aggravation, which may last three, five, or thirty years, the patient becomes greatly emaciated, partly paralysed, and entirely demented. A number of these unfortunate beings commit suicide, as a rule by drowning; the majority end their days in the lunatic asylums of their respective countries. The disease affects the agricultural classes almost exclusively; town people are everywhere absolutely immune.—C.D. Oct. 22, 1910. From the *Times*, Oct. 15, 1910.

Books on pellagra.—B.M.J. ii./11,1021.

PELLAGRA FIELD COMMISSION.—Eating of Maize either sound or deteriorated can no longer be considered the cause of pellagra. Sambon's theory as to a parasitic infection possibly conveyed by some insect is probable. Pellagra occurs in districts where the sand-fly *Simulium* exists.—L. W. Sambon, L. ii/,10, 1709. B.M.J. ii /11,/613.

Treatment by direct transfusion of blood. The recoveries (58%) following transfusion in the grave type of cases compares most favourably with the recoveries (10-20%) in the same type of case in which other therapeutic measures are employed. A few days after the transfusion gradual increase in body weight and improvement in mental condition was noticed. Recovery was established in a period varying from one to four months. No advantage has been noticed in the employment of a donor who has recovered from pellagra as compared with the donor who has never had pellagra.—B.M.J. ii./11,1276; L. ii./11,526; see also Investigation of.—L. ii./10,1709: L. ii./11, 556,1524. In Egyptian prisons they are now using maize bread.—L. ii./11,916.

YAWS (*Frambœsia Tropica*) Treatment. Sodium Bicarbonate in 1 drachm doses, together with Copper Sulphate locally.—B.M.J. ii./05,1275. Potassium Iodide 10 to 20 grains for adults, 2 to 5 grains for children thrice daily. If anæmic, Ammonio-Citrate of Iron. Locally Mercuric Nitrate Ointment (1 in 3 Vaseline.)—B.M.J. ii./07,868.

FRAMBŒSIA in Ceylon. Potassium Iodide in large doses best routine treatment; Atoxyl, Sodium Cacodylate, and Quinine Cacodylate also useful.—L. ii./07,1458. Characters of the *Spirochæta*.—B.M.J. ii./07,1511. See also 'Salvarsan.'

An exceedingly contagious disease. Potassium Iodide in.—B.M.J. ii./05, 1276.

DHOBIE ITCH.—Severe prurigo of the thighs is due to various Fungi.

TINEA CIRCINATA.—The fungi of this are distinct from those of dhobie itch, though all belong to Trichophytons.—B.M.J. ii./05,1278.

PARANGI.—(Allied to syphilis ?) Spirochetes found.—B.M.J. ii./05, 1280.

**Sleeping Sickness**, see **Trypanosomiasis.**

**Sprue and Hill Diarrhœa.** Features are sore tongue, stomatitis, peculiar form of diarrhœa, due to varieties of bacteria. Milk diet recommended.—B.M.J. ii./05, 1281. Trilactine (*q.v.*) should prove of value.

**Sporotrichosis** (due to *Sporotrichon beurmanni*).—A case of, treated by liberal doses of Potassium Iodide—80 grains per diem. Locally Iodine in the form of Gram's Solution is useful. The Iodine appears to act indirectly by stimulating absorption. Patient was in addition suffering from a ringworm infection (*Tricophyton Rosaceum*) of the nails. Cultural characteristics and peculiar properties of the fungus suggest that it may be overlooked. In all granulomata which cannot be clearly attributed to the ordinary causes of such lesions the possibility of Sporotrichosis should be kept in view.—B.M.J ii./11,1.

**Staphylococci** are easily recognised by their grouping. They are Gram + , and smaller than streptococci, but whether *S. Aureus, albus,* or *citreus* cultivation gives growths, *e.g.*, on a tube of Agar, of the colours in question. They are the most easily grown of all the pathogenic bacteria.—Wingrave on aural discharges, M.P., Sept. 23, '08,343.

**Hepatic Abscess.**—A case in which the patient had coughed up gallons of pus, arrived in England from India weighing 5½ stones—a mere skeleton. Open air treatment and a vaccine prepared from his organism (*Staphylococcus longus*) obtained from the sputum restored to health (weight 12½ stones). Dose commencing with 5 million and advancing to 100 million. Examination of the blood prior to making the Vaccine showed patient's resisting power to this particular organism was non-existent. Other cases due to *S. lanceolatus and Staphylococcus aureus.*—Hale White and Eyre.—L. i./09, 610.1588.

A case of recurrent attacks of fever with endocarditis disturbance (Streptococcic infection) every three or four weeks, had an index falling to about 0.5 or lower just before the attack. After 4 or 5 days 1.2 or over when the attack ceased, falling again after a week or two. A special Vaccine when the index had dropped to its lowest, caused a rapid rise and complete abortion of the attack. The injections were repeated several times with good result. A recurrent case of this kind throws light on the problem of recurrent sore throat with the possible sequel of endocardial infection.—Pr./09,650.

**Streptococci** (Gram +) in aural discharges of two types:—
(1) *S. longus* (*S. pyogenes vel erysipelatus*) in long chains, (2) *S. brevis* in short chains is held to be pathogenic, (*S. longus vel S. Salivarius*) which is common in the mouth and throat is said to be non-pathogenic. Marmorek, however, holds that the length of chain is variable, and Widal has shown that the non-pathogenic forms from the mouth when cultivated with B. Coli become pathogenic. -Wingrave.—M.P. Sept. 23, '08, p. 343, See also **Septicæmia.**—'
**Vaccine Chapter.**

It is thought that the strains of *Streptococci* and *Staphylococci* are as numerous as the varieties of '*Rubus*' and the distinction of the colors 'Aureus, 'Citreus.' 'Albus,' etc., do not by any means represent their numbers.—B.M.J. ii. 10,1115.

**Syphilis.—Spirochæta Pallida.** *Syn.* **Treponema Pallidum**

*Spirochæta Pallida* has been cultivated by Noguchi. The material employed was syphilitic testicular tissue of the rabbit, the medium used being Serum Water (from the horse, sheep or rabbit), to which was added a piece of sterile rabbit tissue. Subsequently growths on solid medium were obtained, the spirochetes were mixed with bacteria,—latter were removed from the cultures by growing through a Berkefeld Filter, which removes bacteria.—B.M.J.E. ii./11,48.*c.*/ **226**

It can be found in the eye (Oph. Oct. 1907)—this may give a hint as to how interstitial keratitis, iritis and choroiditis are brought about in later life.—Oph. June, '07, p. 303; L.ii./07,1835.

Alive may well be seen by parabolic or dark ground illumination, *infra vide.* Dead by mixing film with liquid Indian Ink.—*vide* **Burri's Ink**, *infra.*

*Demonstration :* As they chiefly infest the lymph stream, the spirilla may be obtained by "needling" base of ulcer or adjacent enlarged gland. Make film, fix in warm air, and stain 12 hours by Giemsa's Solution at 37° C.; obtained only with difficulty from surface of ulcer.

*Characters.*—Gram negative. Smaller than *Sp. foetida :* regular and symmetrical corkscrew spirals, shorter than *Sp. buccalis,* greater number of turns. *Vide infra* for differentiation from other *sp.*

**Giemsa's Stain.**—Dissolve Azur II.—Eosin 3 Gm. and Azur II. 0.8 Gm. (previously well dried in exsiccator before weighing, and powdered as finely as possible) in 250 Gm. Glycerin (chem. pur.) without heat, add Methyl Alcohol 250 Gm. Shake well, allow to stand at room temperature 24 hours and filter

It is convenient to keep a little of the stain thus made in a drop-bottle and add from this 1 or 2 drops of the stain to every Cc. of water in the staining bath. Staining of films or 'smears,' previously fixed in alcohol 15 minutes, is allowed to proceed for 15 to 60 minutes (Giemsa) in a shallow dish (some workers favour much longer), wash in water, dry and mount. Over-stained preparations should be treated with water to remove excess. See also B.M.J. ii./06, 738 for a more concise way of making.

The material called Azur II.-Eosin is composed of Methylene Azur and Methylene Blue in equal parts and Eosin chemically combined in a manner not stated by Giemsa in his papers.

Long and dilligent search necessary in looking for the *Spirochætæ* stained by this method. Table of differences between this and other kinds of *Spirochaetæ.*—B.M.J. i./09 455.

This stain imparts to the spirochete a distinctly reddish violet tinge, similar to that of the neighbouring leucocyte nuclei (the Romanowsky chromatin stain), whilst the bacteria in the preparation come out blue.—B.M.J. i./05, 1263.

McDonagh, Pr. Nov.1910, works as follows:—After fixing, the film or smear on slide (or cover slip) is covered with the diluted stain and heated until vapour comes off for half a minute, leave for half a minute and pour off stain, repeating this four times; then wash with distilled water, dry and mount. The *spirochæta pallida* is stained pink and the *Sp. refringens* blue.

## Examination of Unstained Specimens.

The old methods of examining the spirochæta in the hanging drop, and by staining with Giemsa's Stain have been completely superseded by the **Dark-ground illumination**, the **Chinese ink method**, and the **staining in vivo**, by means of Methyl Violet.

**Ultramicroscope.**—Employed for demonstrating in a rapid, easy and certain manner the presence of the living organism. Useful to examine a scraping when it is necessary to give an opinion on a doubtful primary or secondary syphilitic lesion. Syphilis cannot of course be excluded because the organism cannot be detected on one examination.

**The Ultramicroscope** is a paraboloidal immersion-condenser. The rays of light used are deflected so that they converge obliquely on the object examined, which appears as a bright refractive body on a dark background. In this way very transparent objects which are invisible by direct elimination are easily seen.

*Treponema Pallidum* seen thus is an extremely fine silvery spiral from 6-15 $\mu$ in length, with very regular or closely set spirals (about 7 to the diameter of a red blood corpuscle). The spirals vary from 10-26 in number. Extremities are pointed. If so focussed that only the summits of the spirals are illuminated the organism looks like a series of bright dots, not unlike a chain of Streptococci. It is feebly motile, its movements consisting of rotations round its long axis, backward and forward movements, and bending movements, which are the most marked. It preserves its spiral form during rest.

*Sp. buccalis*, *Sp. refringens*, *Sp. balanitidis* are much larger with wider and more open spirals. *Sp. refringens* has only 3 to 5 turns and is usually blunt at either or both ends. The only spirochætes very like the specific organism are (1). *Sp. dentium*, found in carious teeth, which is shorter (5 to 10 $\mu$), 5 to 15 spirals, the wave length the same as *T. pallidum*, but depth of wave is considerably less; (2). *Sp. pertenuis* (yaws), Castellani; (3). *Sp. pseudo-pallida*, Loewenthal (ulcerated cancers). In the last two the spirals are not quite so deep or regular, and in the case of *Spirochæta pertenuis* the ends are often twisted into rings or loops.

*Treponema Pallidum* is found below the surface, and should be sought at the margin of the lesion. It cannot be detected in the centre of an ulcerated or necrosed area where the saprophytic spirochætes may be seen in large numbers. The organism is found in the largest numbers in mucous plaques, is constantly present in varying numbers in primary untreated chancres, and is usually detected in the papular syphilide and in scrapings from a recently removed enlarged syphilitic lymphatic gland.

The margin of the chancre, papules, or mucous plaque should be gently scraped till blood just begins to exude. The surface is now dried with a swab of plain sterile gauze, and then a little blood or serum expressed. A small drop of this is removed with a platinum needle and mixed with a drop of distilled water on a thin glass-slide. A thin cover-glass is now pressed down firmly, so that only a thin layer of fluid remains between the slide and cover-glass. A drop of immersion oil is now placed below the slide and on the cover-glass. The condenser must first be accurately centred. This can easily be done with a low objective (1 in. or ⅔ in.) by means of concentric rings scratched on the surface of the condenser.

Any artificial light can be used—electric (arc or Nernst), gas (incandescent), or even an oil lamp. Concentrate the light to the centre of the microscope mirror. After the slide has been placed in position so that there is a layer of oil between the ultra-microscope and the under surface of slide, and after the object is focussed, the ultra-microscope must be racked up or down and the mirror adjusted till bright illumination with dark back-ground is obtained

General or local treatment has a marked effect on the number of treponemata found, and the organisms tend to disappear after a few weeks from the site of the primary inoculation, even without treatment.—H. W. Bayly, P.R.S.M., Clin. Sectn. Nov. '09, p. 3.

Antiseptics must not have been previously applied to the sore.—B.M.J. ii./11,686.

**Chinese Ink Method (Burri).** The method is known in Germany as 'Tusche Verfahren.' Burri's work, 1909, on the subject is published by Gustav Fischer, Jena.

The method requires no special apparatus. A platinum loopful of secretion from a sore is placed on a slide and mixed with an equal quantity of Distilled Water and an emulsion of Chinese Ink. The whole is mixed and spread on the slide like a blood film, allowed to dry and examined with oil immersion lens. The ink produces a dark background and the objects stand out white. It is easy to differentiate the two forms of spirochetes.—McDonagh P.R.S.M. Apl. 1910, p. 73, Pr. Nov. 1910.

**Meirowsky's Methyl Violet in vivo Staining Method.**—A suspension of Methyl-Violet in Normal Saline rubbed into an ulcerating primary case or into an ulcerating condyloma, the serum of the patient taken a few minutes afterwards (at the point of rubbing) will show *Sp. Pallida* and *Sp. Refringens* stained. The intensity of staining can be gauged by the depth of staining of the lipoid hollows of the red corpuscles,—same must be deep blue-violet. In this way *Sp. Pallida* stains bright violet and *Sp. Refringens* dark blue-violet.—Münch. Med. Woch. No. 27, 1910, p. 1452.

J. E. R. MacDonagh, Pr. Nov. 1910, states:—

The sore is cleaned and upon it the Stain is pressed for about two minutes. On rubbing off the excess, expressing serum and preparing as for dark ground-illumination, the *Sp. Pallida*, with an oil immersion lens, is seen moving about and is easily distinguished.

**Comparative Value of Staining Methods**—

*Sp. Refringens* under dark-ground illumination is seen to shoot rapidly backwards and forwards in a straight line and when not rotating so actively is often seen to squirm its way by corkscrew movements, pushing blood corpuscles, bacilli, etc., aside. The diagrams illustrating this paper show the marked difference between this organism and *Sp. Pallida*. Serum obtained by swabbing is preferable for examinations to scrapings. In staining with *Siemsa's Stain* (diluted 1 in 8) at least 12 hours is best. In the *Indian Ink* method at least twice the volume of Indian Ink to the drop of serum. Spirochætes are more constantly present in condylomata and mucous patches and far less constantly present in papular secondary skin eruptions than in primary sores. *Dark Ground Illumination* is the best method of examination. —B.M.J. ii./11,1283.

**Gentian Violet staining of Sp. Pallida.**—

The stain is prepared on the lines of Gram's Anilin-Violet for bacteria:—

Shake 3 Cc. Anilin Oil with 20 Cc. distilled water for 5 or 10 minutes and to the filtered liquid add half its volume of a concentrated alcoholic solution of Gentian Violet Fix smears by holding over 1% Osmic Acid Solution for one to two minutes. Pour the Stain over the specimen and heat 20 to 30 seconds over a flame. Wash off with water, dry and examine with oil immersion lens. Spirochætes appear reddish-blue against a rose-colored ground —*Sp. Refringens* being stained more deeply.—Klausner, Berl. Klin. Woch. Jan. 23, 1911, per L. i./11 321.

**Lead Subacetate Method.**—Fix with Osmic Acid as above, wash in water and cover for 10 seconds with a solution consisting of Liquor Plumbi Subacetatis 1, Water to 100. Again wash and cover 10 seconds with a 10% Aqueous Sodium Sulphide Solution. Wash and repeat whole process twice. Apply Osmic Acid Solution 30 seconds, wash and dry. Spirochætes, cell debris and bacteria appear black.—A. A. W. Ghoreyeb. Publications of Mass. Gen. Hosp. vol. III., No. 2. p. 267, Jl. A.M.A. May 7, 1910, per L. i./11,321.

Syphilis transmitted to an ape. Spirochetes found on the 37th day after inoculation.—B.M.J. i./06,607.

Comparison with other Spirochetes and some Protozoa. Jackson Clarke.—B.M.J. i./06,1274.

The Spirochete can be demonstrated from an exposed surface; from an enlarged gland (remove fluid with hypodermic needle) from the blood (take 1 Cc. of blood from a vein, mix with 10 Cc. of 0.3% Acetic Acid and centrfugalise) from tissues, from syphilitic eyes (examination of aqueous humour). Staining methods.—Oph., April 1907, 189.

Notes on the examination of 'smears' of the *S. pallida*.—B.M.J.ii./07,1510.

The development of the halteridium in the mosquito, as found by Schaudinn, is doubted—at any rate has never been followed by anyone else.—B.M.J. ii./07,88.

An atlas of 38 plates of Spirochetes has been issued as a memorial of the late Fritz Schaudinn.—B.M.J. i./08,278.

Yamamoto has worked out a modification of the Silver Nitrate method of staining in the tissues.—L. i./09,933.

Biochemistry of syphilis. 'Lipoids' and *Spirochaeta Pallida* described.—L. i./09,489.

Gland puncture and examination of exudate. *Sp. pallida* has always been found in same during the period between the first typical hardening of the gland and the first eruption (6 to 10 weeks).—B.M.J.E. i./09,25.

*Sp. pallida* in the body in congenital syphilis, study of. In greatest numbers in the liver, but also present in the lungs, spleen, suprarenal gland, kidney and skin. In the skin, as in the liver, it is in enormous numbers.—M.P., Feb. 24, 09' 202.

**Noguchi's Method of Diagnosis of Syphilis.**—(*Distinguish from the Noguchi modified Wassermann test*) Boil two parts of the cerebro-spinal fluid with 5 parts of a 10% solution of Butyric Acid in normal saline for a few seconds, then add one part of Normal Sodium Hydrate and again boil briefly. A flocculent or granular precipitate is obtained on standing (in parasyphilitic affections) due to presence of a globulin. The test distinguishes general paralysis from other forms of insanity not associated with meningo-encephalitis.—L. i./09,1666, B.M.J. i./09,1112,1408.

Persistence of disease organisms in the body. In syphilis and tubercle the respective organisms once admitted have their potentiality for mischief terminated only by death of their host. In the case of cancer probably the same condition exists, though as yet no causative germ relating to it is known.—B.M.J. i./11,973.

**Cultivation of Sp. Pallida.**—Serum water, to which a piece of sterile rabbit tissue (preferably kidney or testicle) has been added, is inoculated from the artificially infected testicular tissue of the rabbit (not from human lesions). The Serum (in test tubes) is rendered suitable for anærobic cultivation by a layer of Paraffin Oil poured upon its surface. After the first cultivation strict anærobiosis is not essential,—the organism can be subcultered on to solid media such as gelatin or agar. The first growths are usually contaminated by other bacteria. Two methods are suggested for separating these from the Spirochætæ:—(1) To grow the Spirochetes through filters which retard the passage of other organisms, or (2) a method depending on the fact that in stab cultures the Spirochetes grow away from the line of puncture into the surrounding medium, while other bacteria fail to do so. Noguchi states that Spirochetes cultivated by these methods are pathogenic in so far that after inoculation into the rabbit's testicle they produce characteristic histological changes and are found growing freely in the infected tissue.—H. Noguchi.—Jl. A. M. A. July 8, 1911, per L. ii./11,536, *c.f.* also *p.* **223**.

***Wassermann's Reaction for the Diagnosis of Syphilis*** was first published in Deut. Med. Woch. of May 10, 1906 by Wassermann, Neisser and Bruck. It is an application of the general phenomenon of deviation or fixation of Complement first described by Bordet and Gengou in 1901.

"**Complement**," (*syn.* **Cytase, Lysin, Alexine**), which is present in fresh blood serum (whether syphilitic or not), has the power of hæmolysing, disintegrating or dissolving blood corpuscles *i.e.*, **Hæmolytic Action.** It is "fixed" in the reaction by the combined action of Specific **Amboceptor** which is present in syphilitic serum and "**Antigen.**" It can also be destroyed by heating at 56° C. for half an hour.

The original Wassermann reaction is complicated,—in this, for example, the antigen is a saline extract of a syphilitic foetus. Subsequently various workers showed it was possible to employ an alcoholic extract of heart muscle, *inter alia*, in place of this substance, but the greatest simplification so far introduced is the use, notably by Hecht and Fleming, of the "Complement" and hæmolytic Amboceptor *of the serum to be tested*, operating with these on sheep's blood corpuscles.

Other modifications are those of Noguchi, Emery, and Wechselmann, which will be considered later.

If Antigen + Syphilitic Serum + Sheep's Corpuscles, be mixed together hæmolysis does not take place.

But if Antigen + Normal Serum + Sheep's blood be used hæmolysis does take place.

Similarly with Syphilitic Serum + Normal Saline Solution + Sheep's Corpuscles hæmolysis occurs.

To follow the last statement one must remember Syphilitic Serum contains Complement as well as Amboceptor, and the Complement was not previously inactivated by adding Antigen.

**Antigen.** (A bacillary product).

Is contained in an Extract of an infected organ, *e.g.*, syphilitic liver. An extractive of an ox heart is now used instead. It has no restraining action by itself on the Complement.

**Amboceptor,** (*Syn.* **Immune body** or **Fixative**, is formed during immunisation, and has no restraining action by itself upon Complement. These *two* together will, however, inactivate Complement in any Serum and so prevent Lysis.

As *Syphilitic Serum* contains *Amboceptor* and *Complement*, in Hecht's or Fleming's method (*q.v.*) of applying the test the Complement is not previously inactivated, and consequently extra Serum is not required in the test (*vide infra*).

Wassermann employed as Antigen **a saline extract of the Liver of a syphilitic fœtus,** the serum of a rabbit immunised to sheep's red corpuscles as Amboceptor and fresh guinea-pig serum as Complement. The test can be done equally well with saline extracts of normal liver and other organs. Alcoholic Extracts, however, keep better. Alcoholic Extracts of the heart (human, sheep, rabbits, or guinea-pigs) are useful (other substances of a lipoid nature such as Sodium Oleate, Cholesterin, or Sodium Glycocholate will do also, but Ox Heart Extract is the best).

The natural hæmolytic Amboceptor for sheep's corpuscles in human serum was found to be as useful as that of the immunised rabbit which was dispensed with, but the Complement of the guinea-pigs' serum was still required. Hecht made the serum to be tested supply the Complement as well as the Hæmolytic Amboceptor. He employs small quantities in comparison with the test as originally described.

For **Flemming's Method** of conducting the test are required,—

**Antigen** (Ox-Heart Extract):—

Heart muscle 1 Gm. is ground up with 5 Cc. Absolute Alcohol and heated at 60° C. for one hour and then allowed to stand 24 hours at 37°C. The supernatant liquor is poured off and diluted with Normal Saline Solution before use in such proportion that while completely binding the Complement of a syphilitic serum it will not interfere with the hæmolitic power of normal serum. Too large a percentage of Alcohol must not be present, as if used hæmolysis will take place when sheep's corpuscles are added even in the absence of serum. No extract should be used which requires to be in a strength exceeding 10%, *i.e.*, Alcoholic Extract 1, Normal Saline 9. The strength of the Extract is tested by taking say 1, 2½, 5, and 10% and using each with a syphilitic and a non-syphilitic serum in the manner described. The strength is chosen which will completely prevent hæmolysis with the syphilitic serum, but which will have no effect on normal serum. Heart Extract thus prepared retains its activity for a long period of time.

**'Antigen' Sterules** are prepared. Another form of 'Antigen' as above mentioned is

**Sodium Glycocholate Solution** but is far less reliable.

Sodium Glycocholate 1, Sterile Distilled Water to 100.

N.B.—This must be fresh, as the solution is favourable to bacterial infection.

Instead of the usual Alcoholic Extracts of Ox Liver or Guinea-pig heart as Antigen it has been found that **Lecithin** and **Lecithin plus Cholesterin** are more sensitive as Antigen.—B.M.J. ii./11,748.

Action of Cholesterin and its derivatives on Lecithin as Syphilitic Antigen and as hæmolysin with Cobra venom.—Jl. Path. Bact., Oct. 1911.

**Washed Sheep's Corpuscles**, from the fresh blood suspended in Normal Saline. Remove fibrin from fresh blood by clotting—rapidly stirring at the time of drawing from the animal. Centrifugalise and pipette off the Serum. (N.B.—A powerful centrifuge is required.)

Add Normal Saline Solution and again centrifugalise several times to free from Complement. Finally dilute with Normal Saline Solution making approximately a 10% suspension.

**Sterules of Washed Sheep's Corpuscles Suspension** are prepared and may be relied upon for a reasonable time.

*Method of conducting the test.*

In carrying out Fleming's modification of the Test, the first requirements are the bent capsules (Wright's) as full as possible of (*a*) normal, (*b*) patient's and if possible of (*c*) a known syphilitic blood. To fill a capsule break off the tips of same, and after pricking the first or second finger about a ¼ inch away from base of the nail or other convenient place, make the blood flow into the bent end of the capsule by capillarity. This is done by swinging the arm, bending down so that the hand is at a level of the foot, winding a bandage several times tightly round first and second joint and intermediate portion of the finger,—then, after pricking, as indicated, with a " flamed " needle, it is possible by flexure to produce a flow of even 5 Cc. of blood if desired. The blood may, if preferred, be collected similarly from the lobe if the ear. Having at least half-filled the capsule, both ends are carefully sealed, avoiding heating the Serum as much as possible, and the Serum is allowed to separate naturally or by the aid of a centrifuge.

Make a file mark round the normal blood capsule just above the level of the Serum and break off carefully. Next snap off the end of an Antigen Sterule and finally treat a " Normal Saline " Sterule in like manner.

Make a small mark on the stem of a long-pointed **Wright's 'pipette'** (3-inch pieces of ¼-inch glass tubing drawn out into a 6-inch capillary point and provided with a teat at the thick end) with a paraffin pencil about half an inch from the point. This is termed 1 volume,—a similar mark is made 2 inches from the point indicating four volumes. Draw up with this pipette volumes of the various liquids and introduce into diminutive corked tubes (about 1 inch × $\frac{3}{16}$ inch) in a small rack in two rows, as follows:—

| | | | | | | |
|---|---|---|---|---|---|---|
| | 1 volume Control Serum, 4 volumes "Antigen." | 1 volume Syphilitic Serum, 4 volumes "Antigen." | 1 volume Patient's Serum, 4 volumes "Antigen." | | | 4 volumes "Antigen." |
| Back Row | B. | D. | F. | H. | J. | X |
| Front Row | A. | C. | E. | G. | I. | |
| | 1 volume Control Serum, 4 volumes Normal Saline. | 1 volume Syphilitic Serum, 4 volumes Normal Saline. | 1 volume Patient's Serum, 4 volumes Normal Saline. | | | |

Tubes G.H. and I.J., etc., can be used to do two or more patients' sera simultaneously.

Into X place 4 volumes of " Antigen " alone.

In all the above the "Antigen" is to be diluted 1 volume with 99 volumes of Normal Saline in a separate little tube or Cc. measure before taking up the volumes. It may be necessary, however, to vary the strength of this " Antigen " dilution from time to time. Its strength should first be tested by taking various dilutions, say 1 in 100, 1 in 40, 1 in 20, 1 in 12, 1 in 15, etc., and using each with a syphilitic and a non-syphilitic serum—that strength being chosen for conducting the reaction which will completely prevent hæmolysis with the syphilitic serum, but will have no effect on the Normal Serum.

Insert corks and shake the contents of each tube slightly and maintain at 37° C. for one hour. After which add 1 volume of washed Sheep's Corpuscles to each tube, including " X," and incubate again for from 1½ to 2 hours.

The results are then read off, but sharper differentiation is obtained if the tubes are inserted in the ice chest for several hours so as to allow of sedimentation in the non-hæmolysed tubes.

We shall get :—

Hæmolysis in " A," owing to absence of " Antigen " and Specific Amboceptor.

Hæmolysis in " B," owing to absence of Specific Amboceptor.

Hæmolysis in " C," owing to absence of " Antigen."

NO Hæmolysis in " D," because Complement is fixed.

Hæmolysis in " E," owing to absence of " Antigen."

NO Hæmolysis in " F," *if patient syphilitic*, owing to added " Antigen," otherwise Hæmolysis as in " B."

NO Hæmolysis in " X " should be observed.

Note tubes " C " and " D " are only for control purposes and need not be used in routine work. The process is an exceedingly delicate one, and the original article by A. Fleming (L.M. I./09, p. 1512) should be studied—these notes are only a *résumé*.

In some cases there is a deficiency of Amboceptor to sheep's corpuscles shown by absence of hæmolysis in tube A, C, E, G, or I. If so, repeat the test, but before adding the sheep's corpuscles add a small quantity of hæmolytic Amboceptor in proportion of 1 to 500 of Corpuscles Suspension, and shake. Or, add to each of the tubes containing the serum concerned one volume of Normal Serum (heated to 56° for 10 minutes), which is known to have a hæmolytic power for sheep's corpuscles. This deficiency, however, only occurs in about 10% of cases.

In a very few cases the addition of Complement may also be necessary. This can be done by adding same in the form of guinea-pig's serum containing Complement only or fresh human serum containing both Complement and Amboceptor before the first incubation period. Thus one puts in one tube (F) 4 volumes of "Antigen," 1 volume of patient's serum and 1 volume of fresh Normal Human Serum, while in the control tube "E" the "Antigen" is replaced by Normal Saline Solution.

In our hands Fleming's method has given good results, though at first it gave anomalous data, *e.g.*, hæmolysis in Syphilitic Serum in presence of Antigen, and in the Antigen tube alone, and then again no hæmolysis in Normal Serum when there should be complete hæmolysis. We tried a large range of dilutions of the Concentrated Antigen Solution, 1, 1¼, 2½, 5, 7½, 10, 12½, 15 and 20% in Normal Saline, ultimately a 4% Dilution was found to give the best result.

The following is an abstract of an account by Prof. Muir of the research leading up to the reaction :—

"The story really concerns the anti-substances which appear in the blood as the result of immunisation, and the first step was made with the discovery of antitoxins, first in the case of tetanus, and a little later in the case of diphtheria. These were the first known anti-substances, and we now know that they combine with the corresponding toxins so as to form a substance inert towards the cells of the body; beyond this neutralising action they have, so far as is known, no other effect. It was, however, shown later that a great many bodies other than toxins, such as ferments, bacteria, serum, milk, or cells of another species, might give rise to anti-substances when injected into an animal, and all such substances are now generally known as *antigens*, on account of this property. In some instances the anti-substance produced some distinct and easily recognised change when allowed to interact with the corresponding antigen. For example, when an animal was treated with injections of foreign serum, the anti-substance developed might lead to the formation of a precipitate when added to the antigen, hence it was called a *precipitin*; or again, when bacteria, were used in the injections, the anti-substance might cause clumping or agglutination of the corresponding bacteria, and hence was called an *agglutinin*. The study by Pfeiffer of the serum of animals highly immunised against the typhoid or cholera organisms showed that the increased bactericidal action possessed by their serum was due to two substances, of which one was specially developed in the process of immunisation (an anti-substance), and the other was present in the normal serum; the former is now known as an *immune-body*, *amboceptor*, the latter as *complement* or *alexine*. Further researches have shown that in all cases where a dissolving action is developed during immunisation, two corresponding substances are concerned. For example, when an animal is injected with the red corpuscles of another species, its serum acquires remarkable hæmolytic properties towards such corpuscles; if the serum be heated at 55° C. for an hour, the hæmolytic property is lost, because the complement is destroyed at that temperature, but it is restored on the addition of fresh normal serum containing complement. It follows from this that corpuscles treated with the corresponding antiserum, heated to destroy complement, serve as a test for the presence of complement; if complement is present, the corpuscles will undergo lysis; if complement is absent, or has in some way been used up, the lysis will not occur. There are two other points to be noted. The first is that each anti-substance is specific (within certain limits); that is, each anti-substance exerts its effect only against the antigen which has led to its production. The other is that anti-substances are formed not only in response to an artificial inoculation, but are developed in the course of an attack of the natural disease: in other words, during the latter a process of immunisation, attended with the formation of anti-substances, appears to be going on. Accordingly, in the serum-diagnosis of disease we test for the presence of the anti-substances to the particular bacterium, and of these the two chief varieties usually considered are the agglutinins and the immune-bodies. As is now well known, the presence of the former is shown by the clumping of the causal bacterium, which occurs on the addition of the serum in suitable dilution from a case of the disease, to an emulsion of the bacterium ; with regard to it nothing more need be said. How can an immune-body be demonstrated ? The answer is, that immune-body, along with the corresponding bacterium, will lead to the using up or fixation of complement, and thus interfere with the lysis of sensitised corpuscles when these are added to the mixture. This reaction is often known as the "Bordet and Gengou phenomenon," *c.f.* also p. **253**, inasmuch as these observers showed that the injection into animals of a great many different substances as antigens—bacteria, foreign proteins, milk, etc.—gave rise to immune bodies, each of which, in association with the corresponding antigen, fixed complement, and thus prevented the lysis of sensitised corpuscles.

'Now with regard to the complement test as applied to syphilis. After the *spirochæta pallida* had been discovered by Schaudinn and Hoffmann 1905, and established by further researches as the cause of the disease, it seemed only reasonable to enquire whether the deviation of complement reaction was given by the serum of syphilitic patients. The observation was first made by Wassermann, Neisser, and Bruck in 1906, and it was found that the phenomenon in question really occurred. Their method was to make a watery extract of a congenital syphilitic liver, which was very rich in spirochætes, to serve as antigen (seeing that, of course, a culture of the organism has not been obtained), and the effect of a mixture of a small quantity of this extract and of syphilitic serum on guinea-pig's complement was tested ; the result, as stated, was that complement was fixed, whereas with serum from other than syphilitic cases this did not happen. Apparently, then, in syphilis, just as in various bacterial diseases, a specific anti-substance (immune-body) could be demonstrated in the blood. The subject assumed, however, quite another aspect when a little later it was found by Marie and Levaditi that an extract of normal liver and of other organs could be substituted for the extract of syphilitic liver, or in other words could take the place of the supposed antigen ; alcoholic extracts are specially suitable for the purpose. Further observations showed that solutions or suspensions of substances of definitely known constitution, such as glycocholates oleates, lecithin, and other lipoids, could be used in place of syphilitic extracts . that is ,when mixed with a syphilitic serum, fixed complement. Thus, the application of the principle of the deviation of complement by an antigen and its anti substance, as demonstrated in the case of bacterial diseases, has led up in the case of syphilis to the discovery of a phenomenon of a different nature. All that we can at present say regarding the Wassermann reaction is that there is present in the serum of syphilitic subjects a substance, *probably a modified protein, which, in the presence of other bodies, especially lipoids, leads to the fixation of complement and that this reaction constitutes the most valuable method of diagnosis which we possess.*'—R. Muir, Glasg. Med. Jl. Nov. 1910.

The **original Wassermann Test** is conducted as follows :—"About 10 Cc. of blood are removed with a syringe from a vein at the bend of the elbow, and transferred to a sterile test-tube. The serum is allowed to separate spontaneously from the clot ; before use it is heated for half an hour at 57° C., then a fixed amount of the serum (0.05 c.c.) is added to a series of small test-tubes in which the fixed amount (0.6 Cc.) of emulsion of organ extract has already been placed (the organ extract is made by macerating one part of minced organ—ox liver or heart—in four parts of 96% alcohol for twenty-four hours ; the emulsion is made by adding one part of extract to five parts of saline). Varying amounts of complement—normal guinea-pig's serum—are added to the series, and after one and a half hour's incubation at 37° C., the test blood suspension is added—1 Cc. of 5% suspension of washed ox's blood corpuscles sensitised with five doses of immune body from the rabbit. After further incubation for one hour at 37° C. the result may be read. Three control series are always set up at the same time as the experiment, *viz.*, (1) the patient's serum (0.05 Cc.) in saline ; (2) the organ extract emulsion (0.6 Cc.) by itself—to these two series complement is added so as to estimate the inhibitory effect of each of these reagents by itself on the complement ; (3) varying amounts of complement are added to saline to estimate exactly the hæmolytic dose of complement. These series are incubated at the same time as the experiment, and they also receive sensitised blood suspension.

"The result is positive when the mixture of patient's serum and organ extract absorbs five or more doses of complement in addition to the amounts absorbed by each reagent alone. Thus, supposing that the patient's serum by itself absorbs one dose of complement and the organ extract emulsion by itself absorbs two doses, then the mixture of serum and organ extract must absorb at least eight doses of complement, as shown by absence of hæmolysis of the test corpuscles in the tube to which this amount of complement had been added, if the reaction is to be counted positive.

"The criterion of a positive reaction is based on the result of the examination of a large number of known syphilitic and non-syphilitic sera. In practice, a number of factors must be taken into account. Thus, the physical state of the emulsion of organ extract is of importance. A turbid emulsion made by floating the alcoholic solution on to the top of the saline and then mixing slowly is much more efficient in eliciting a positive reaction with syphilitic sera than is a clear emulsion made by mixing rapidly the same amounts of alcoholic extracts and saline. Again, the complement-containing serum obtained from different guinea-pigs shows individual variations, some animals yielding complement which is much more readily deviated than others. Provided that the examination is always controlled by testing at the same time as the patient's serum a known negative serum, there is no danger of obtaining an erroneous positive reaction with a non-syphilitic serum. On the other hand, a weakly positive serum may be overlooked on a single examination, but a repetition of the test will usually clear up the diagnosis.

"The reaction is essentially a quantitative one, as it depends on an accurate estimation of the amount of complement absorbed by a mixture of organ extract and serum as compared with the amounts absorbed by each reagent alone.

"Browning, Cruickshank, and M'Kenzie's modification depends on the fact that the amount of complement absorbed by a mixture of serum and lecithin is increased on the addition of cholesterin if the serum is syphilitic; but not if the serum is normal. Accordingly, two series of tests are carried out simultaneously—in the one, complement is added to the mixture of serum and lecithin; in the other, to the mixture of serum, lecithin, and cholesterin. If more complement is absorbed in the second series than in the first then the the reaction is positive."—C. H. Browning, Glasgow Med. Jl. Nov. 1910.

## *References.*

Parasyphilitic conditions, as instanced by tabes and general paralysis vary somewhat. General paralytics give positive results in every case,—tabetics do not give it in more than 60%. Most of those who failed to give the reaction denied all history of syphilis. When energetic treatment has produced a cure the patient will fail to respond to the test. Time will show whether this is the case,—if so the test will be of very considerable value.—B.M.J. i./09,1238; ii./09,984; L. i./09,1457, 1512.

Objection has been raised to Fleming's and allied methods to the effect that 'hæmolytic power for sheep's corpuscles was not found in 30% of human serum, and that in 22 known cases of syphilis the reaction had not been obtained in half the number. Fleming has quoted other workers as having found 10% failures. Clemenger finds in 500 observations only 5% which did not possess hæmolytic action—does not think this will detract from value of the reaction—any deficiency can be supplied by adding a small amount of normal hæmolytic serum in these cases.' Clemenger finds that 'in practically all cases of syphilitic lesions, whether primary, secondary or tertiary, a positive reaction can be obtained providing suitable heart-extract is used.'—B.M.J. ii./09,575. See also *ibid p.* 917.

The test is of value where no spirochætæ are found.—L. i./09,481.

Browning and Mackenzie's modified method. 125 out of 135 cases of syphilis gave positive reaction, and 107, out of 108 with no evidence of syphilis, gave negative results. The control cases included a large variety of acute diseases—pneumonia, enteric, scarlet fever, etc.—L. i./09,1521.

Wassermann's reaction generally accepted not specific, and that it is more probably an increase in the lipoid content of syphilitic serum rather than the interaction between a specific body and an Antigen that produces the complement fixation,—possibly this substance is present in all sera and that there is a marked excess in syphilis. Did not obtain such clear results when depending on the hæmolytic action of human serum instead of adding special hæmolytic serum. 200 tests employing rabbit's heart extract. Neisser technique modified employed. Reaction not due to Mercurial treatment.—L. i./09,1523.

Doubts whether lipoids alone responsible for the test—if so they must be present in enormous excess. Unlikely that such a pathological cell activity should only be found in one infection. Wassermann's Technique followed in the main. No difficulty in obtaining the 2 Cc. of patient's blood necessary. The objection to Bauer's method of making use of the amboceptor normally present in human serum in place of sheep's corpuscles, is that the natural amboceptor varies considerably and in a few cases is practically absent, so that the serum of such an individual could not be tested by the method.—149 cases. L. i./09,1515.

Original Wassermann, notes on.—B.M.J.E. ii./08,17.

The original Wassermann Test regarded as specific and reliable. Especially useful when applied to the cerebro-spinal fluid for diagnostic purposes.—Mott. B.M.J. i./09,461.

Wassermann could report 1010 non-syphilitic serums examined without a single positive result. Spinal fluids from 64 cases of general paralysis and other diseases examined at Mott's request—59 of the 64 gave positive result—clinical evidence connecting tabetic and general paralysis with syphilis. Method employed essentially Wassermann's but ox blood corpuscles used instead of sheep's.—Henderson Smith and Candler.—B.M.J. ii./09,198.

Auto-inoculation and re-infection of syphilis.—J. Hutchinson. L. i./09, 1509.

Cytodiagnosis, lymphocytes markedly increased in 80 progressive parasyphilitic affections.—Mott. L. i./09,489,1354,1666; B.M.J. i./09,1408.

The differential diagnosis of syphilis and parasyphilis of the nervous system. The doctrine has been put forward that "general paralysis is, like tabes, a consequence of syphilis, and that the two diseases are so similar in their etiology that they might probably be regarded as one disease affecting different parts of the nervous system." Others have said that "General paralysis is the product of syphilisation and civilisation." Practically every case of general paralysis gives a positive lymphocyte and a positive Wassermann reaction.—F. W. Mott. B.M.J. ii./11,1337; L. ii./11,1392.

Syphilis of the nervous system. The cerebro-spinal fluid of 127 cases of varied forms of insanity examined for Wassermann Reaction. 64 of these were general paralysis, and in 59 or 92.1% a positive result was obtained. 21 of the 59 since dead from general paralysis.—Mott, P.R.S.M., Neurol. Sectn., Feb. '10, p. 35 *et seq.*

Wassermann Test in general paralysis. The reaction is one of the most reliable and valuable tests for general paralysis. A positive reaction was obtained with the cerebro-spinal fluid in 90%. of cases. The **Liver Extract** was made in this investigation slightly different from the original. The liver was reduced to an anhydrous powder by mixture with Plaster of Paris and silver sand—then washed with Acetone and finally extracted with cold alcohol,—this was thought to eliminate substances adversely affecting the test.—L. ii./11,1320.

900 cases reported on. Visible change in regard to response by those under treatment.—L. i./09,432.

Positive reaction (original Wassermann) in scarlatina the exception not the rule.—B.M.J.E. i./09,28.

Porges' modification of Wassermann, (using Sodium Glycocholate).

Positive reaction is definite evidence of past syphilitic inoculation.—Harry Campbell. B.M.J. i./09,567,640.

Out of 57 cases in which a clinical diagnosis of syphilis had been made positive reaction was obtained in 50. The syphilitic liver extract kept good for 6 months.—B.M.J.E. i./09,60.

Wassermann modified by using for Antigen dried syphilitic congenital liver. Primary cases marked reaction. All cases of early secondary syphilis positive results; in late secondary or tertiary manifestations results more variable. 50°/₀ of para-syphilitic cases positive reaction.—B.M.J. ii./09, 325,377.

'Solving the problem of half a dozen variables.' Advances are being made that will speedily bring the test into daily use. No one has projected a simpler rationale than Fleming—room for further simplification of Flashman and Butler's method.—B.M.J. ii./09,1087.

Wassermann's original employed—to be regarded as specific. Necessity for obtaining a comparatively large amount of serum overcome by diminishing amounts of reagents used. With regard to Antigen aqueous extract of a liver rich in spirochætes is best. Some difficulty in interpreting results. Discussion of reliability of the test and theoretical considerations. A lengthy article with bibliography of 74 authors.—B.M.J. ii./09,1019.

In cardiac disease. Positive reactions in a number of cases seemed to indicate that syphilis is an important factor in the production of cardiac disease.—L. ii./09,1159.

Ehrlich showed that hæmolytic amboceptors can be developed in the serums of animals injected with the red corpuscles of other animals of the same species. Experiments by Batty Shaw show that it is possible to develop in the serums of animals into which injections have been made of the organs of another animal of the same species, in part at least an increase of the hæmolytic power of the serum. *Emulsions of* different organs seem to have varying power of checking hæmolytic power of these experimental serums,—kidney emulsion most and liver least.—B.M.J. ii./09,1268.

Hecht's modified Wassermann method.—Wien Klin. Woch., 1908, No. 50.

Woman infected through her child *in utero*. Colles' law upset. Women show no sign of the disease until the menopause when tertiary lesions appear.—P.R.S.M. Dermat. Sectn., May 1910, p. 91

The test is useful in the diagnosis of secondary and tertiary syphilis, but not in cases of early chancres.—Pr., Oct. '10,430 J. Mc-Donagh, Pr., Sept. '09.

With regard to Wassermann's reaction MacDonagh (Pr., Nov. 1910, p. 671) writes as follows:—

'It was my custom to employ both active and inactive patient's serum, one serving as a control against the other; the reason for so doing was owing to the fact that in inactivating the serum at 56° C. for half an hour, complementoid bodies were formed which had the power of acting like complement, causing thereby a negative reaction in one which should have given a positive. *Wechselmann* ingeniously showed that these complementoid bodies could be precipitated by barium sulphate, his method of procedure being as follows:—0.9 Cc. of inactivated serum is mixed with 3 Cc. of physiological saline solution and 0.5 Cc. of a 7% fresh precipitated barium sulphate saline emulsion, the mixture being well shaken, then put into an incubator at 37° for an hour, it is then centrifugalised and 1 Cc. is used for the reaction. The barium sulphate acts probably mechanically, and it matters little whether more than the above quantity is used.' This method should be used, 'since it not infrequently happens, that an undoubted case of syphilis, especially in the late stage of the disease and not under the influence of treatment, gives a negative reaction in the ordinary course of events and a positive with the barium sulphate prepared serum.

Although this addition adds considerably to thelabour, it, at the same time, by increasing the positive results in syphilitic cases, enhances the value of a negative reaction. The best antigen is that prepared from a syphilitic liver, and, contrary to what serves for Wassermann's reaction, an extract of a normal organ, be it human or animal, is useless. It is extremely doubtful whether this test will become generally employed and prove of diagnostic value, but, nevertheless, it is a step in the right direction, since we cannot rest in peace until we have probed the foundations of the Wassermann's reaction."

**W. D'Este Emery's Method.**

Many fatty substances, *e.g.*, Lecithin, produce the same result as when Antigen is used. The substance in the serum is therefore not a true antibody, and it is, moreover, not specific, since it occurs in other diseases, and in normal serum, but in syphilis it is in excess,—hence the importance of a quantitive method of application.

All sera give some absorption of complement with liver extract if the latter be strong enough. The reaction, *may in fact be explained somewhat* as follows: The dilution of the alcoholic fatty solution produces an emulsion of fine particles. Syphilitic Serum contains a substance with power to combine with these, and in so doing alters in some way the surface tension between them and the fluid in which they are suspended,—hence they clump and in doing so *attract to themselves any complement* which may *be present in the fluid.* The reaction is therefore partly physical and partly chemical. Note that antigen changes in strength (as a rule becoming stronger) also that the diluted extract is more turbid and has a more powerful action if the two fluids are allowed to mix gradually and not mixed at once. One or other proceeding must always be used. Emery floats the Alcoholic Solution on top of the Saline and allows it to diffuse gradually 10 minutes, and then slowly stirs them together.

In the original Wassermann and other modifications the complement originally present in the Serum is destroyed by heat at 55° or 60° C. Emery thinks this may hide the ultimate reaction—possibly by linking together the complement and some of the so-called syphilitic antibody. The explanation usually given for first eliminating complement and then adding it in the form of guinea pig serum is that the amount in human serum varies so much as to make the test unreliable. Emery thinks this explanation unsatisfactory,—the complement added is in no way known or estimated. Some workers dry the complement on filter paper,—this must be inaccurate. It is true some methods attempt evaluation of complement, but the process is lengthy and the estimation is probably of little use the next day. Emery uses unheated serum and fully sensitised human corpuscles,—this will work with even a trace of complement.

From results it is clear that the presence of large amount of complement does not vitiate results. The hæmolytic system is simply an indicator analogous with the use of litmus in titration. Emery objects to the use of sheep's corpuscles. Amboceptor is not always present (or not in sufficient quantity) in human serum to link up with its complement to these corpuscles. Hence non-syphilitic serum has to be added, but the *amount* to add is not easy to say. *Human* corpuscles are used in Tschernugobow's, Noguchi's, Birt's and Emery's processes—they involve the use of an immune serum to supply the necesary amboceptor to link up the pre-existing complement.

**Emery's Method** is as follows:—Prepare an emulsion of sensitised washed human corpuscles by adding 1 volume of corpuscles to 4 volumes of heated immune serum from a rabbit which has been injected with human corpuscles. This serum must be strong enough to sensitise the corpuscles to a trace of complement, and not strong enough to clump them instantly. The dilution is found experimentally and the serum diluted accordingly. Enough of this 20% emulsion of corpuscles is prepared to last for about 10 tests. The mixture is incubated a few minutes to allow of the linking up of the amboceptor and is then ready for use.

In the test 1 part of serum to be tested is mixed with 4 parts of Saline Solution (about 5 C.mm. in all by means of Wright's capillary pipettes). Place in water bath at 38° C.; next a mixture with diluted antigen in the same proportion is placed alongside,—this being the test, the other the control. Other sera to be tested can be placed alongside in the customary manner. The combination takes place in five minutes or less—there is no need to wait the customary hour. Next add 1 volume of the Emulsion of sensitised corpuscles to each tube—mix up thoroughly. If the balance between amboceptor be right, the corpuscles in the control will be dissolved before they have time to settle, and if not they must be stirred once or twice,—the actual 'test' tubes being treated likewise. In a few minutes the results can be read. In a *negative reaction both tubes show haemolysis*, complete or nearly so; in a *positive one* the *first tube only* shows it, whilst in the latter the corpuscles will settle leaving a colorless supernatant fluid. With regard to **Standardisation of Antigen** this should be compared with *normal* not with syphilitic serum. Emery advises and *suggests as standard* the use of an extract of such strength that when diluted 10 times its volume it exerts a definite inhibiting influence on a normal serum, but does not cause complete inhibition except in a small proportion of cases,—*Normal Human Heart Muscle* is used. The extract is prepared 1=1 with Absolute Alcohol (see paper. L. i./11, p. 567, for details) also for details of the Quantitative Method to which justice cannot be done in a short abstract.—L. ii./10,732; i./11,564,594.

**Von Dungern** introduced a modification of Wassermann's Test.

In this method the complement is provided in strips of filter paper, soaked with guinea-pig serum and dried. The antigen is an extract of guinea-pig heart, dissolved in alcohol. The immune-body is contained in the serum of an animal treated with injections of human red blood corpuscles. The test is carried out as follows:—Two test-tubes are filled each with 2 Cc. of normal saline, to one of these a drop of antigen is added. A piece of the complement-paper is then added to each. A few drops of the patient's blood is put into a watch-glass, stirred by means of a match until it is defibrinated, and 0.1 Cc. added to each tube. After an hour a little immune-serum is added to each tube. If the patient is syphilitic, the red corpuscles in the test-tube containing antigen are agglutinated in a few minutes and sink, while the supernatant liquid remains clear. In the other tube, the red corpuscles remain suspended and soon become dissolved, forming a bright red solution. If the patient is not syphilitic, the contents of the first tube also behave like that of the second one. The method is said to be delicate.—Münch. Med. Woch. Mar. 8, 1910; per Pres. Aug. 1910.

## *RECENT REFERENCES TO THE WASSERMANN TEST.*

Wassermann's Reaction with cerebro-spinal fluid. A positive reaction is obtained when the blood or cerebro-spinal fluid causes fixation of complement of guinea-pig serum. A reliable aid to diagnosis.—F. W. Mott, L. ii./10,82.

A large proportion of dead bodies gave the reaction—not necessarily attributable to syphilis. It is not of value on such as diagnostic.—L. ii./10,204.

Blood Serum of Idiots examined.—15% gave the reaction. Not unreasonable to assume a causal relation between syphilis and idiocy.—L. ii./10,227.

*Failures of the Reaction.*—Mistakes are more often due to defective system of applying it than to the method itself. Warning against neglecting the clinical symptoms and relying exclusively on the results of the Wassermann's reaction.—L. ii./10,263.

B.M.A. (1910) Discussion on Complement—Deviation methods in diagnosis, Prof. Wassermann's paper,—B.M.J. ii./10,323,1427. H. W. Bayley on the practical value of the reaction, *ibid.*, p. 1430, R. Muir on Fixation of Complement in general, *ibid.*, p. 1430. J. Henderson Smith on the Structure of Complement in relation to deviation, *ibid.*, p. 1433. T. W. Bassett Smith on Diagnosis by Complement deviation, *ibid.*, p. 1434. Ivy McKenzie on Individual properties of Complement and organ extract, *ibid.*, p. 1435. H. R. Dean on comparison of the Original Method with some of its Modifications, *ibid.*, p. 1437. L. W. Harrison on Guidance afforded, *ibid.*, p. 1438. C. H. Browning on Lecithin and Cholesterin as Reagents, *ibid.*, p. 1439. J. O. W. Barrett on Complement Deviation in relation to carcinoma, *ibid.*, p. 1440. Leader, *ibid.*, p. 1450.

Useful in determining the specific nature of atypical lesions,—*e.g.*, apparently non-syphilitic soft sores, of extragenital sores and of manifestations of the disease where primary and secondary symptoms had been suppressed. As a means of diagnosis the reaction is supplementary to the examination for spirochetes, and where these are scanty, as in tertiary lesions, it is available alone.—L. ii./10,1491.

Suggestion of State control in Germany of the necessary 'extracts' for the test.—they vary from day to day.—L. ii./10,1584.

A. Fleming on Syphilis and the Wassermann Reaction.—P.R.S.M. —Surgical Sectn., July 1910, 219.

Congenital Syphilis irrespective of treatment, tends to give a + Wassermann Reaction, which is not altered, however much Mercury is given.—McDonagh, P.R.S.M.—Nov. 1910, Otol. Sectn. p. 22.

In 5 cases of phthisis the only sign of syphilis was a + reaction discovered after death. At the necropsy the condition of the lung was suggestive of old syphilis. This seemed to support the view that syphilis affecting the lungs predisposes to phthisis. Post-mortem examinations in general give a correct diagnosis in non-syphilitic cases. As a rule if the reaction is + during life a syphilitic area will be found post-mortem.—B.M.J.E. ii./10,20 *q.v.* for further data on these lines.

Association between syphilis and cancer of the stomach. The surgeon should avail himself of the Wassermann Test before exploring the upper abdomen. Syphilis is stated to be a commoner cause of disease than is at present recognised. A not inconsiderable number of cases simulating cancer of the stomach are thought to be the result of syphilis.—B.M.J. ii./10,952.

Boas records 1064 control observations on normal individuals and on cases of other diseases than syphilis. Of these only one case,—one of scarlet fever—gave a positive reaction. In countries other than tropical ones the reaction is specific. He regards the test as not infallible in the first stage of syphilis. In secondary and tertiary syphilis it is infallible provided patient has not previously undergone any treatment. The reaction in general is far more marked in cases which have not been treated than in those that have. In latent syphilis only a + reaction be taken as of any diagnostic value. In general paralysis of the insane a + reaction occurs constantly with serum, also almost always with the cerebro-spinal fluid.—L. ii./10,1705; B.M.J. i./11,1432.

Plaut (The Wassermann Sero-diagnosis of Syphilis in its application to Psychiatry) comes to the conclusion that *the orginal Wassermann's method is alone to be trusted.* With regard to general paralysis he considers it important to test both serum and spinal fluid.—B.M.J. ii./11,760.

In two lectures on 'Recognition, Treatment and Prophylaxis of Syphilis,' Major French deals with all the recent developments. Effects of treatment on the Wassermann Reaction by Mercurials, Salvarsan and Iodide are specially entered into. The value of the Wassermann Test as diagnostic is most critically surveyed.—L. i./11,1315,1316,1386.

Comparative value of the various methods of antisyphilitic treatment as estimated by the Wassermann reaction. Salvarsan first, inunction or intramuscular injection of insoluble Mercurials second; Mercurial Pills and Suppositories a "bad third."—L. ii./11,1332.

Emery finds that in the early part of the primary stage a — result is of value, but a reaction may be expected if the supposed chancre has been present for six weeks or more. Children and adults with hereditary syphilis usually give strong reactions. In the later stages if the reaction is present the patient is not cured. If there is no reaction it is difficult to decide, but if a reaction has been present, and is subsequently, the probability of cure is great, but ***Mercury itself inhibits the reaction.***—L. i./,11,595.

**Influence of Drugs on the Reaction.** Casoni took sixteen individuals, twelve of whom were definitely non-syphilitic, and four suffering from syphilis, and observed their reaction to the test before and after giving the following drugs: Iron Citrate, Sodium Arsenate, Strychnine, Guaiacol, Sodium Glycerophosphate, and Quinine. In the twelve non-syphilitic cases the Wassermann reaction was negative both before and after treatment. In the four syphilitics one remained unaffected by treatment, the reaction being positive all the time. Of the remaining three, in one the reaction disappeared completely under arsenic, and in the other two it was much less marked. Quinine abolished it entirely in one, while it did not modify it in the others. It was only the quinine and arsenic which modified the reaction, and this not in every case. Iron, Strychnine, Guaiacol, and Glycerophosphate had no effect in this respect. —B.M.J.E. i./11,24.

***Serum for Examination, transmitted from abroad*** must be collected, under aseptic precautions, transferred to a sterile vessel, inactivated at 56° to 60° C. for ½ hour and sent in cold storage.—B.M.J. ii./10,240. *Or proceed thus* :—

**Examination of Dried Serum.** The blood is collected in the usual way in a bent Wright's Tube, and allowed to coagulate. A definite quantity of the Serum is pipetted off and allowed to dry on blotting paper. This can then be treated with Normal Saline and made up to its original volume for conducting the test.

**Stern's Modification** has its uses. The original Wassermann being less sensitive, is less likely to mislead in diagnosis, while the more sensitive modification of Stern is more likely to give early evidence of retrogression and of the necessity for further treatment.—B.M.J. ii./11 686,693.

**Noguchi's Modified Wassermann's Test** is thought to be neither simpler than the original, nor an improvement on it. The use of human amboceptor is fraught with the danger that antibodies active to human albumins may act inhibitorily on the hæmolysis.—Deut. Med. Woch. 26, 1910, per B.M.J.E. i./11,52. The reader is referred to Noguchi's Book on the subject for the technique.

**Tick Fever.**—This is evidently relapsing fever (*vide* p. **226**), and the spirochete is *S. Obermeieri* (not yet certain however).—B.M.J. ii./04,1453; i./06,680; M.A., 1906,88.

It is suggested that the spirillum may be a stage in the life history of trypanosoma (?).—Jl. Trop. Med. 1904, 24.

Suggested to designate the spirochete of African Tick Fever *S. Duttoni*. Differs from that of New York.—L. i./06,1690. The spirochete of this and relapsing fever (Leishman).—L. i./07,806.

*Sp. Duttoni* (associated with Tick Fever) can be maintained virulent for wild mice in artificial media for 40 days. It will multiply and can be successfully transferred in artificial media—Egg Yolk in mouse decoction was the most successful medium.—L. i./09,834.

Through the bite of ticks from Nyassaland, collected in the hut of a native in whose house cases had occurred, Leishmann was able to infect a monkey. The spirochetes appeared in the blood of the animal on the sixth day and it died on the thirteenth day. From the monkey, transmission had been possible to mice.—B.M.J. ii./08,1435.

**Tropical Ailments** as met with in Great Britain—malaria, hæmoglobinuria, dysentery and sprue, beri-beri, &c.—J. Cantlie, B.M.J. i./07,1465.

GUINEA WORM, DRACUNULUS MEDINENSIS.—Life history of, see Leiper. Rep. Advisory Comm. of the Tropical Disease Research Fund, 1906; also B.M.J. i./07,129,157.

### Trypanosomiasis or Sleeping Sickness.

The disease is endemic on the West Coast of Africa, notably in the Congo Basin. It is believed to be caused by the entrance into the blood and cerebro-spinal fluid of the parasite *Trypanosoma Gambiense*. It causes a complete dislocation of the brain functions, slow inflammatory process goes on in the brain cells for years, gradually the individual becomes languid in the extreme, he has not physical energy enough to walk, speak, or even feed himself. The trypanosome of Gambia was first named and described by Dutton, who lost his life in 1905 in West Africa whilst engaged in his work on this disease. The blood or cerebro-spinal fluid of an infected person has been injected into a monkey with result that the animal died with all the symptoms of sleeping sickness. It is transmitted from the sick to the healthy by a tsetse fly (*Glossina palpalis*) and not by other biting flies (*Stomoxys*). In the stomach of this fly the trypanosome multiplies by fission. The parasite was discovered by Castellani in Uganda, but an Englishman, Dr. Adams (1901) first entertained the idea that sleeping sickness was caused by Trypanosomes.

Mott gives some analogies between trypanosomiasis and syphilis. Possibly the fashion in which the two organisms (*T. Gambiense* and *Sp. Pallida*) originally invaded man was the same. *T. Gambiense* can usually be found in the blood with ease, *Sp. Pallida* cannot, and seems able to multiply only in lymph spaces and channels. Possibly the deadly results of infection with *T. Gambiense* as compared with other trypanosomes is due to *T. Gambiense* having acquired the habit of migration into the subarachnoid space.

As to Organic Arsenic bodies Mott thinks possibly the trypanocidal and spirillocidal action due to their stimulating phagocytosis,—possibly to their having an affinity for the phosphorus-containing lipoids of the periplasmic membranes of the organisms in question. Toxic effects of Organic Arsenic Compounds on the other hand may be due to its union with the lecithins of the nervous system. Patients, therefore, seem to stand between the devil and the deep sea.—B.M.J. ii./10.1647.

Spirochetes are generally believed to be linked to the protozoa rather than to bacteria. A Spirochætal invasion clinically differs from a bacterial one and conforms especially to certain trypanosome infections and there is great similarity of the histological lesions of the nerve tissues of chronic trypanosome infection,—*e.g.*, sleeping sickness and the *mal de coit* (Dourine) of horses (transmitted by *T. Equidermum*)—to syphilitic and parasyphilitic lesions. There is further similarity in the fact that lymphocytes and plasma cells are found in the cerebro-spinal fluid in trypanosome diseases of animals and man, *e.g.*, sleeping sickness.

*Sp. Pallida* though now transmitted direct from man to man was possibly at one time dependent upon a biting insect, just as now is the Spirochete of tick fever.

One essential difference in effects on the nervous system between *T. Gambiense* and *Sp. Pallida* is that whereas every case of this trypanosome infection leads finally to invasion of the nervous system, yet in syphilis not more than 5 or 10% even of untreated cases do this. The reason is probably that trypanosomes are very active and motile and may be able to readily penetrate the delicate capillary walls of the nervous system; Spirochetes on the other hand are slow and sluggish in movement.

Trypanosomes are always found in the cerebro-spinal fluid. Spirochetes have never been demonstrated in it.

*T. Gambiense* is the special organism of sleeping sickness whether acquired in the Congo State, or any other portion of Africa. Europeans are just as easily attacked as the natives. It is very doubtful whether the Organic Arsenic Compounds, Mercury, Trypan Red, etc., though causing the trypanosomes to disappear from the blood, will attack same when once in the cerebro-spinal fluid, as these drugs do not pass from the blood into the cerebro-spinal fluid. Various workers have suggested that the trypanosome may pass into *latent* endocellular form.

Some experiments on clearing the natives from the shores of Victoria Nynaza were thought to prove that Glossina Palpalis retained its infectivity for a period of two years, but there may be numerous means of re-infection of the flies.

Full clinical Study and Pathological data of Human Trypanosomes, *vide* Mott.—P.R.S.M. Path. Sect. Nov. '10, p. 1, *et seq.*

Spirochetes are regarded as primitive or transitional forms leading up from the bacteria and their allies to the flagellates. Doflein's Lehrbuch der Protozoenkunde is advised as a complete study of Protozoa from the zoological standpoint.—B.M.J. i./10,142.

Involution Stages of Trypanosomes.—Na. Oct. 1911, 575.

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Research was instituted by arguing from analogy with the Tsetse-fly disease n cattle. It was found that *Glossina palpalis* can carry the disease for a period of 48 hours from the sick to the healthy.

The *glossina* must be exterminated, but in addition immunisation experiments have been undertaken, the principle being to pass a strain of trypanosoma through different races of animals until a certain degree of virulence is lost. Laveran has made preliminary attempts by means of horse serum. A similar process was carried out by Koch with success in the allied Indian disease in horses—surra.

The blood of 117 people from districts where sleeping sickness is unknown was found by Bruce and Nabarro not to contain a single trypanosome.

In addition to finding the trypanosomes in the blood, a very useful method is to examine the lymphatic glands; the trypanosomes are here very numerous and motile in incipient sleeping sickness. The fluid is easily removed with a hypodermic needle on puncturing.

The glandular enlargements in sleeping sickness are probably caused by the arrest of the trypanosome in the glands, where, indeed, many of them are destroyed, but whence some escape from time to time into the blood, and thus produce the increase which has been observed in the peripheral circulation. The wearing of clothes is the only reason assigned for the fact that Europeans have been thought to be immune.—L. ii./03,542,553,788,990 (staining); 1673 (cultivation); 1717 (Report of Expedition to Senegambia); P.J. ii./03,839.

The condition of the stomach in sleeping sickness is a marked feature. It is comparable with the petechial hæmorrhages met with under the endo- and epicardium of the heart in other trypanosomic affections.—L. ii./05,1909.

The trypanosome was found in the spinal fluid of 70% of cases (34) of sleeping sickness—in all of which the spinal fluid was examined. Sleeping sickness presents three stages. Koch's immunising experiments.—Castellani, B.M.J. ii./04,71.

Laveran—a paper on prophylactic inoculations against trypanosomiasis, malaria, and piroplasmosis.—L. i./06,1198.

Nabarro and Grieg show sleeping sickness can be conveyed by other species than *glossina palpalis.*—B.M.J. ii./06,1881.

Meat is one of the cravings of the sufferers. Of 300,000 round the Victoria Nyanza 200,000 were swept out of existence.—'The Times,' April, 1908.

Nabarro points out that he and Col. Bruce experimentally proved the trypanosome to be the cause of sleeping sickness. It was found constantly not only in the cerebro-spinal fluid, but also in the blood. He also claims credit for having discovered sleeping sickness to be carried by *Glossina palpalis.*—Jl. Trop. Med. July '08,224.

Hodges does not see any need to suppose the existence of any other means than *Glossina palpalis* of spreading the infection amongst human beings.—Sleeping Sickness Bureau, London, L.i./09,483.

Examination of infected villages showed that '*palpalis*' villages are more heavily infected than the '*morsitans*.'—B M.J.i./09,403.

Prevention of sleeping sickness.—Knowledge is much needed concerning the habits of *Glossina.* Gland palpation is a valuable test in diagnosis. Other biting flies may also transmit trypanosomiasis.—B.M.J.ii./08,1061.

The extermination of the tsetse fly is, however, a labour of Sisyphus. The fly has a marked objection to Citronella Oil. Areas planted with this grass are free from the fly.—L.i./09,701.

Serum Therapy suggested,—*i.e.*, the injection of a highly immune serum obtained from the blood of patients recently recovered,—or rather, as these are few and far between, of patients subjected in the first instancse to chemotherapy (Atoxyl, &c.).—L. i./09,716. The injection to be intra spinal—the serum could be taken from a patient improving. The blood of those suffering from trypanosomiasis contains trypanocidal bodies—the intra-spinal treatment could be combined with chemical treatment through the blood.—B.M.J. i./09,1176.

Liquor Arsenicalis as routine suggested treatment.—B.M.J. i./09,681.

If a fly, three weeks after feeding on an animal suffering from sleeping sickness, were incapable of giving infection, trypanosomes were not found in its stomach. Further, trypanosomes were not found in flies which had been kept from infection, nor in flies fed on healthy monkeys.—B.M.J. ii./09,903.

Potassium Chlorate 0·03 Gm. in ½ Cc. of 1 in 10,000 Saponin Solution efficacious in prolonging life of guinea pig infected with trypanosome. Similarly 1 mgr. of Arsenious Acid in ½ Cc. of 5% Anilin Chloride Solution. By the last mentioned, trypanosomes were made to disappear permanently, but not stated to be a definite cure.—B.M.J.E. ii./09,56.

Observations on various spirochetes show that they divide both longitudinally and transversely, usually one after the other, but may occur simultaneously.—B.M.J. ii./09,1244.

Bagshawe on advances made during 12 months prior to Oct. '09, in prevention and cure of sleeping sickness. Kleine showed that it takes about 20 days in the case of *T. brucei* after the fly has ingested the trypanosome before it is capable of infecting susceptible animals. Bruce confirmed this for *T. Gambiense.* Some flies probably remain infective for the rest of their lives. Bruce introduced fluid swarming with trypanosomes from the gut of a fly, fed 75 days before on an animal infected with *T. Gambiense* and subsequently on healthy animals,—into a monkey. After 8 days the monkey became infected. This indicates some form of development, whether a sexual process or merely multiplication as seen in cultures is not known. Sleeping sickness does not become endemic except in districts in which *glossina palpalis* is in evidence. That this fly is a transmitter of human trypanosomiasis has been known since 1903. Sexuacoitus has been thought by Koch and Kudicke to explain the occurrence of the disease in *palpalis*-free areas. The suggestion that other "auxiliary" flies are responsible in addition is refuted. Diagnosis by direct examination of the blood gave a large percentage of successes, particularly on centrifugalising as also the examination of the glands, cervical and submaxillary, in particular. Gland palpation is employed in preliminary diagnosis. A single dose of Atoxyl will cause marked retrogression in the size of infected glands—the larger the glands the more likely the existence of trypanosomes within. In the matter of symptoms it would appear that paralysis, paresis, and epileptiform convulsions, which among untreated cases, occurred in small percentage, are now commonly met with, and are often followed by sudden death, which was very exceptional before the use of Organic Arsenic.

*Sudden or rapid death was frequently the termination of cases of sleeping sickness treated with full courses of Organic Arsenic.*

There are indications that nature is working out a cure for herself by attenuating the virulence of the trypanosome, or by some other factor or combined factors.—L. ii./09,1193 ; B.M.J. ii./09,767 ; *see also* Jl. Trop. Med., Nov. 15, 1909.

Set of applicances for removing blood and staining.—L. ii./09,1220.

The following notes are taken from the "**Report on Measures adopted for the suppression of Sleeping Sickness in Uganda by Sir H. Hesketh Bell, K.C.M.G.**, being Parliamentary Colonial Report, No. 63 Uganda.

The disease appears to have come from the Congo basin. At Kampala in 1901 eight cases of a mysterious disease were first noted.

The total mortality in the Uganda Protectorate from the scourge up to end of 1906 considerably exceeded 200,000. A number of investigators were sent out by the Royal Society. Koch, who arrived in 1906, devoted himself to curative methods, using Atoxyl in particular in large and repeated doses, The method seems hopeful, but in view of the protracted duration of the disease, and variety of the phases, some years would have to elapse before any cure could be considered permanent. The disease so far appears to be *incurable.* The best recommendation seems to have been to remove the entire population to fly-free areas. Citronella plantations are in a flourishing condition, and probably drive away several kinds of noxious insects, but they have been disappointing, (*Vol. I, p.*811). The segregation camps justified existence in several particulars. Drugs have prolonged lives, but not a single undoubted cure among thousands of cases that have passed through the camps.

In February, 1909, Kliene stated that the trypanosome must pass through a cycle in the fly of at least 17 days, and until this had happened it was unable to transmit the disease. He proved flies capable of conveying infection up to the 75th day. Bruce later found *Glossina palpalis* capable of retaining infectivity for two years.

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Deaths during 1909 only 459, as against 5,000 in 1907. *Vide* also Na. May 5, 1910, p. 280, for a recent *résumé.*

Excessive liability of European women in Africa to trypanosomiasis owing to skirt form of dress.—B.M.J. i./10,72.

*Glossina Palpalis* regarded as the sole means of conveying trypanosomes to man, although other species are suspected. There is no proof that *T. gambiense* passes through any metamorphosis in *G. Palpalis.*—B.M.J. ii./10,292. But *G. Morsitans* has been found capable of conveying sleeping sickness. 670 *G. Morsitans* from an infected area divided into 16 groups were fed on 16 monkeys,— each group on one monkey. Six monkeys became infected. It was formerly believed that *T. gambiense* could not complete its development in the body of *G. Morsitans* as it does in *G. Palpalis.* Experiments in North Eastern Rhodesia and Nyassaland.—B.M.J. ii./11, 285,1263 ; L. ii./11,459.

*Glossina Brevipalpis* is also suspected. A commission started for Nyassaland to investigate further.—B.M.J. ii./11,1028.

B.M.A. Discussion on Trypanosomiasis. — There is no absolute proof that a single person has recovered from sleeping sickness. There were some 49 cases among Europeans between 1908 and 1910,—in Europeans chance of recovery is greater than in natives. It is difficult to understand how the flies retained infectivity for two years after the native population had been removed from the shores of the Victoria Nyanza. Possible explanations are given. Experimental injections into Hippopotomi, etc., negative so far. With regard to epidemiology, possibly a considerable degree of saturation with *Glossina* is necessary before an epidemic spread of sleeping sickness takes place. With regard to possibility of hereditary transmission of *T. gambiense*, *T. brucei*, etc., by the respective infected *Glossinæ* to their progeny, the majority of experiments so far conducted were negative, but L. W. Sambon still holds this view.—B.M.J. ii./10,864, *et seq.*

**Eighteenth Bulletin of the Sleeping Sickness Bureau.**—It is suggested that *Glossina Morsitans* is harmless to man when occurring on open and relatively high ground and probably dangerous in the presence of a sleeping sickness " reservoir " when inhabiting damp and warm valleys. Possibly the development of the trypanosome in the body of *Glossina*, which in favourable circumstances is only in about 5% of these flies, does not occur in relative cold or dryness.—L. ii./10,323.

E. M. Holmes provides a résumé of knowledge of the disease and the flies.—P.J. ii./10,734.

In the **20th Bulletin of the S.S. Bureau** records of 50 cases of Europeans are given,—of these thirty are known to be dead. One of the survivors, infected probably in 1900, is regarded as cured with Fowler's Solution.—Na. Oct. 13/10,469.

A case of sleeping sickness studied by precise enumerative methods ; *Conclusions.*—(1) The increase of trypanosomes is due to their active multiplication, depending on the following conditions :—(*a*) the liberation of a reproductive stimulant from the dead trypanosomes of the previous fall ; (*b*) the small number of leucocytes, especially mononuclears ; (*c*) the habituation of the trypanosomes to their antibodies ; (*d*) the absence or diminution of antibodies. (2) The decrease of trypanosomes is due to their rapid death, and to a cessation of multiplication depending on the following conditions :—(*a*) the large increase of leucocytes, especially of mononuclears , (*b*) the formation of antibodies in the serum. (3) The trypanosomes remaining between the rises are resistent forms. (4) Extracts of dead cells would appear to stimulate the corresponding live cells to multiply or divide.—Major Ronald Ross and D. Thomson.—Na. Dec. 22, 1910. *q.v.* also a number of Royal Society papers on trypanosomiasis. *Inter alia* may be noted " X " Rays had no trypanocidal action. Small doses of Atoxyl were found to actually *stimulate* certain trypanosomes to divide,—being a tonic.

The staying of the disease in Uganda by clearing the Northern shores of Victoria Nyanza of its human inhabitants can only be temporary. The measure is not curative. It will be necessary to determine whether the animals in the district are capable of acting as hosts of the parasite.—B.M.J. i./11,82.

The domestic fowl is not a reservoir for *T. Gambiense*, but the antelope is possibly. Results of a large number of experiments were negative in every case with fowls.—B.M.J. i./11,253.

Experiments on eleven antelopes showed that after tsete flies had been fed upon them, their blood eight days later transmitted the disease to all the monkeys inoculated, while two-thirds were infected after an interval of thirty days. The antelopes remained in perfect health, although in eight of them trypanosomes appeared in the blood for a few days only. No wild antelope inhabiting the Victoria Nyanza shore has yet been found to be naturally infected. Birds cannot act as a reservoir of the trypanosome.—Sir D. Bruce, Roy. Soc's. Commission Report, Jan. 1911.

**Cold Chamber Treatment.** — Results with animals inoculated with *T. gambiense* and *T. rhodesiense* showed advantage of the treatment. The chamber can be kept at any temperature between 15° F. (9.4° C.) and 150° F. (65.5° C.) The cold is produced by an Ammonia Compressor and a fan which drives in air through a chamber in which Saturated Solution of Calcium Chloride is kept constantly trickling over corrugated iron plates. A sleeping sickness patient underwent the treatment and felt better for it.—B.M.J. i./11, 678.

*Trypanosoma lewisi*,—the common rat trypanosome, is akin to the Trypanosome of sleeping sickness. The mechanism of infection is the act of *eating* infective fleas and not by being bitten or contaminated by them. C. Strickland.—B.M.J. i./11,1049.

Contrary to Strickland (B M.J. i./11,1049) E. A. Minchin and J. P. Thomson bring evidence that infection of rats with *T. lewisi* is not in general normally effected through the rat eating fleas,—they believe that the ripe infective form of the trypanosome,—the final form of life cycle which it passes through in the flea,—is regurgitated from the stomach of the flea into the wound made by the proboscis during the act of feeding.—B.M.J. i./11,1309.

*T. evansi* causes the disease surra in elephants, camels, horses, etc., in India and Africa. The carrier of surra has not yet been identified. There are no tsetse flies in India. Details of differences between *T. evansi* and *T. brucei* are given.—Sir D. Bruce, Roy. Soc. per Na. June 15, 1911, p. 539.

*T. rhodesiense*. the agent in a case of sleeping sickness.—Na. June 15, 1911, p. 539.

Tsetse Flies.—E. E. Austen's Revised Handbook on, Review.—B.M.J. ii./11, 21.

See also Review—The present position of the problem of Tsetse Flies and sleeping sickness.—B.M.J. i./12,382.

*See also Organic Antimony and Arsenic Compounds* (Vol. I.) *for recent treatment and refs.*

**Trypanosoma Gambiense.**—Morphologically, a long-shaped protozoon containing a large nucleus centrally and a vacuole or contractile vessel at the larger end.

The single flagellum proceeds from a small mass of chromatin at the anterior end. This flagellum forms the edge of undulating membrane which is observable from end to end of the organism, and continues in the same direction for some length as a free tail. It measures 18 to 26 $\mu$ by 1.4 to 2 $\mu$.

Analogy has been drawn with certain other flagellates—notably trichomonas, englena and herpetomonas. Trichomonas move both backwards and forwards, Englena and Herpetomonas move only forwards, and the trypanosoma backwards—by the aid of the membrane. At the spot slightly behind the vacuole there are some patches of pigment—the so-called eye spots, centrosome or micronucleus.

Trypanosoma reproduces itself by longitudinal division or fission—in addition there is sometimes transverse fission—and formation of rosettes by multiple division. Before the fission there is a division of the centrosome, followed by division of the flagellum, nucleus and the protoplasm—these dividing forms are not easy to find in the blood.

The organism may be found in large numbers in the blood in every case of sleeping sickness, as also in the lymphatic glands and in the advanced disease in the cerebro-spinal fluid.

There is no great reduction in the number of red corpuscles. The hæmoglobin is also not decreased.—L. i./06,227.

Staining is best conducted with **Leishman's Stain** *q.v.*; some beautiful specimens can be made with this by first pouring on to the film and allowing to stain half a minute, then add twice the volume of distilled water and allow to stain further half an hour. Wash in distilled water and dry in customary manner.

Other methods of staining are with Thionin Blue, Methylene Blue, and Borrel's Blue, *q.v.*

Manson recommends the examination of the blood when the temperature is high: it is well to centrifugalise as the trypanosomes accumulate in the leucocyte layer above the red corpuscles.

Classification of some trypanosomes:—*T. Evansi* (discovered 1880), causing "surra" in India. *T. Elmastiania* (1901), causing mal de caderas in South America. *T. Brucei*, found in cases of tsetse fly disease or nagana, in Zululand, Bruce, 1894. *T. Rouxeti* (1896), the parasite of dourine or mal du coit, occurring in South Europe, North Africa, and other parts. *T. Lewisi*, non-pathogenic, found in rats. On injecting into other animals is removed by phagocytosis. *T. Nepveui* (1890), found in man in Algeria. *T. Castellani* (November, 1902) found in Uganda by Castellani, occurs in the cerebro-spinal fluid in cases of sleeping sickness. It is closely allied to *T. Gambiense*. The tsetse fly, *Glossina palpalis*, is common in the Upper Congo and Uganda; *Glossina morsitans*, as shown by Bruce in 1894, being responsible for nagana, or tsetse fly disease in animals.

Trypanosoma has been cultivated in the condensed moisture which arises from a blood agar medium.

Manson in a lecture on advances of science upholds the view of a sexual reproduction of the Trypanosome in its insect vector.—L. ii./08,991.

### Laveran's Method of Staining Trypanosoma.

Prepare thin blood films, and fix in absolute alcohol 5 to 10 minutes. The following are required:—

(1) *Solution.*—Methylene Blue and Silver Oxide (Borrel's Blue). Prepare "some" Silver Oxide freshly by means of Silver Nitrate and Sodium Hydroxide. Wash the precipitate with distilled water thoroughly, and add to it a saturated solution of medicinal Methylene Blue. Allow to remain for a fortnight, occasionally shaking.

(2) Aqueous Solution of Eosin 1 per 1,000.

(3) Solution of Tannin 5%, or, better, a solution of 'Tannin Orange.'

Mix just before use: No. 1 Solution 1 Cc., No. 2 Solution 4 Cc., Distilled Water 6 Cc.

Stain in a flat dish, film downwards, for 5 to 20 minutes—5 to 10 minutes is enough in most cases. Wash in water and treat with tannin for a few minutes. Wash in water and then in distilled water. If precipitate found on the preparation wash in Clove Oil and brush off with Xylol.

*For further references to Trypanosomiasis, v.* Vol. 1., *p.* 137, 167.

**Bacillus Tuberculosis**, (Now viewed as probably one of the Streptothrix group.) **Ziehl-Neelsen's method**; Sputum and sections.—1. Prepare film from caseous particle of sputum or a section ready for staining, and fix by usual methods. 2. Boil filtered carbol-fuschin in a test-tube and cover specimens with it entirely; stain films 5 mins., sections 10 mins. (**Carbol-Fuchsin-Solution**, Neelsen's Solution, is prepared by mixing Concentrated Alcoholic Fuchsin Solution 1 with 5% Carbolic Acid Solution 9, slightly warmed.) 3. Wash well in water. 4. Decolourise almost completely by immersing in 25% sulphuric acid. 5. Wash well in water. 6. Counter-stain with **Loeffler's alkaline methylene blue**—sputum, 1 to 2 mins.; sections, 3 to 4 mins. This stain is prepared by mixing saturated Alcoholic Methylene Blue Solution 142 mins., with 1 ounce of a 1 in 10,000 solution of Caustic Potash. (Note.—Medicinal Methylene Blue is far more soluble than ordinary and should be used —W. H. M.) A few drops of 10% **Tannin Solution** added to every 100 Cc of Loeffler's Solution is found to improve the stain (Pollard). **Carbolised Methylene Blue (Kuhne)** is also employed.—Dissolve Methylene Blue 1, as much as possible in Alcohol 90% 7, and add Phenol Solution 5% 70, allow to settle and decant. 7. Wash, dry, and mount in Xylol Balsam (sputum 8. If section dehydrate with alcohol, clarify with xylol, and mount in xylol balsam. If dehydrated with anilin oil instead of alcohol a clearer preparation is produced.

Examine wherever possible the first sputum expectorated after the night's sleep.—L. ii./10,1747.

**Fuchsin-Anilin Green Method** for staining B. tuberculosis.

Solution A. Fuchsin 10, Absolute Alcohol 100.
,, B. Strong Ammonia Solution 3, Water 100.
,, C. Alcohol 50, Water 30, Nitric Acid 20, Anilin Green *q.s.* to saturate.

Add one part of A to 10 of B. Warm until vapour arises, immerse 1 minute, wash with water, then immerse in C 40 seconds. Wash off thoroughly. Bacilli red on pale green ground.

Recognition.—Delicate, straight, or more usually slightly curved rods. When stained, usually beaded in appearance. The length of the organism is commonly said to be about one-quarter to one-half the diameter of a red blood-corpuscle, but it varies considerably. Involution and branching forms occasionally met with. (Gram staining).

The Tubercle Bacillus is about 1 $\mu$ in length when grown on Blood Serum and from 1,25 to 6.5 $\mu$ in the tissues.—Hewlett, B.M.J i./12,75.

Present in large numbers when the process is acute, but are relatively scanty or absent in chronic forms of tuberculosis, *e.g.*, Caseous non-suppurating glands lupus, &c

Tubercle Bacilli contained in sputum retain their vitality for a considerable time even when the sputum dries up,

**Rosolic Acid Method.**—Specially for *B. Tuberculosis* in tissues. Stain in hot carbol fuchsin for 5 minutes. Wash quickly in tap water. Dip five or six times in saturated Alcoholic Solution of Rosolic Acid (Corallin) till fuchsin is removed. Wash in water and counter-stain in saturated Alcoholic Solution of Methylene Blue.

**Cultural Characters.** Was first grown on blood serum by Koch, but will not grow without addition of glycerin to the ordinary media. Requires temperature of 37° C. Dry wrinkled growth somewhat like a lichen, on glycerin agar in three weeks. Cultures, especially in glycerinated broth, have fruity odour.

To obtain a pure culture of the organism from tubercular material it is necessary to inoculate guinea-pigs with same, and after a lapse of four to six weeks cultures are made from enlarged glands direct on to blood serum or glycerin potato. Glycerin agar is not recommended for use direct *post mortem*, but the organism flourishes on this on sub-culture.

**Glycerophosphate Culture Medium.**—Analysis of the ash of the tubercle bacillus and of the bouillon in which it has grown led to the preparation of the following culture medium. It has given good results. Sodium Citrate 4 Gm., Glycerin 50 Gm., Byla's Albumose 10 Gm., Glycerophosphates of Sodium 2.24 Gm., Potassium 0.6 Gm., Calcium 1.2 Gm., Magnesium 1.76 Gm., Water 1 litre. The solution is sterilised at 100° C. The maximum amount of Manganese admissable is 3 Gm., of Iron 3.1 Gm,—both being present as Glycerophosphates. The latter corresponds with the amount of Iron in 1 litre of blood.—J.C.S.A. ii./10,531.

The **original Ziehl-Neelsen method** is stated to distinguish *B. tuberculosis* from *Smegma* and other acid-fast bacilli. It is conducted as follows:—

Stain with saturated Alcoholic Fuchsin Solution 10% in 5% Phenol Solution hot for 10 minutes, decolorise in 30% Nitric Acid 2 minutes, washing in water, decolorise in Alcohol 3—5 minutes. Counter-stain finally with Methylene Blue.

POINTS OF DIFFERENCE BETWEEN HUMAN & BOVINE TUBERCLE BACILLI.

| *Human.* | *Bovine.* |
|---|---|
| *Longer and slender.* | *Shorter, thicker, stumpy.* |
| *Fasciculated.* | *Discrete, not in bundles.* |
| *Colour true.* | *Not colour true, receptive of blue.* |
| *Beading well marked and regular.* | *Beading less marked.* |

—Wyatt Wingrave.

**Spengler's Staining Methods.**—Spengler states that in the sputum of a small percentage of phthisical cases, very few or no bacilli are found by the ordinary Ziehl-Neelsen method of staining, but that when the "Farbächt" (colour-fast) method is employed bacilli are sometimes found in large quantities

The explanation given is that these "perlsucht" bacilli, as found in the human being, exhibit such a fine acid-susceptibility that the ordinary Ziehl-Neelsen method, using acid for decolorisation, is unsuccessful.

After the customary Carbol-Fuchsin wash with 60% Alcohol, until no more colour is extracted, leave a little Alcohol upon the film, and stain with Löffler's Methylene Blue.

The "**Picric**" **Method** (for the staining of both types of bacilli). Picric Acid is used as a mordant for the Fuchsin, in addition to the Phenol. Twin films are used for comparison, one being taken for the "Ziehl-Neelsen" method, and the other for the "Picric." Stain with Carbol-Fuchsin with gentle heating. Pour off Fuchsin, and add Picric Acid-Alcohol until film is yellow, wash and dry. (Found delicate.—L. ii./10,1752.)

The **"Hüllen," or Capsule Method** –(suitable for cultures) is employed when it is desired to demonstrate the presence of both types of bacilli, perlsucht bacilli appearing almost "gigantic" as their capsules take the stain. The T.B. on the other hand are very much smaller.

The "Hüllen" method is as follows:—

A thin film is allowed to dry spontaneously. Alkalise with a drop of 1% caustic potash and allow to dry again in the air. Stain with Löffler's methylene blue; wash with water. Stain with carbol fuchsin with slight warming in flame until vapour arises; wash with water. Stain with methylene blue, with slow addition of 1 or 2 drops of 15% nitric acid; wash and dry.

The human organism, by its secretions, has the power to so injure the capsules of the T.B. and P.B. that the Ziehl-Neelsen and "Hüllen" methods are no longer reliable; in these cases the "Picric" method is better. By its use the presence of bacilli is demonstrable even if traces only of the capsule wax remain. These damaged bacilli regain their normal staining properties in stroke culture .

Investigations by R. Curling Styles, undertaken to ascertain if it were possible to obtain results comparable with those of Spengler, gave the following conclusions:—

(1) In no case was a positive result obtained by the "Farbächt" method when the Ziehl-Neelsen gave a negative one. It would appear, therefore, that a pure "perlsucht" infection is rare, or that these bacilli are not in all cases decolorised by the use of acids.

(2) The "Picric" method, undoubtedly, in a large number of cases shows a greater number of bacilli than are rendered visible by the Ziehl-Neelsen method.

(3) No marked difference in size nor in appearance was noticed between T.B. and "perlsucht" bacilli, as they appear in sputum films.

Neither the British Royal Commission on Tuberculosis nor the German Commission found it possible to differentiate between the human and bovine types of tubercle bacilli by means of staining methods.—Pr. Mar. 1911, p. 420.

ANTIFORMIN (Patented in 1900) contains about 7.5% free Sodium Hydrate and 5.3% available Chlorine. Another statement is to the effect that its composition is equal parts of Eau de Javelle (Liquor Sodæ Chlorinatæ) and 15% Solution of Sodium Hydrate. A disinfectant. In 2 to 5% dilution kills most bacteria in 5 minutes. Anthrax Spores, require 10% for 12 hours. It does not, however, kill Tubercle bacilli (probably by reason of the fatty envelope which is believed to enclose them). It can be used to isolate the bacillus from the sputum—particles can be removed by macerating 2 hours 20 to 30 Cc. of tuberculous sputum with 15 Cc. of the Antiformin and diluting with water to 100 Cc. These inseminated on blood serum are stated to produce a pure culture.—M. 08,130. B.M.J.E. ii./08,56; ii./09,8—or may be used for staining direct, *vide infra*.

It dissolves hair, wool, silk, etc,. also 0.5% is stated to dissolve Cholera Vibrios, Spirochetes, Trypanosomes in 5 minutes, while a 2.5 to 5% solution completely destroys vegetative forms of bacteria.

**Uhlenhuth's Antiformin Method of isolating B. Tuberculosis.**—(modified by Koslow). Shake the Sputum with Antiformin in a glass stoppered cylinder, the amount of Antiformin varying with the consistence of the sputum,—if very viscid or dense, an equal volume, if thin, half the amount may suffice, occasionally during five minutes, then dilute with Distilled water approximately 10 times the amount if Antiformin used,—again shake a few minutes. Finally add a mixture of equal parts of Ether and Acetone, equal in volume to that of the water. Shake a few seconds and allow to stand. Three layers will form. The middle one,—a more or less white ring, will contain nearly all the Tubercle Bacillus present in the sputum,—draw off with aid of a pipette and teat. This may be centrifugalised but it is not necessary. Before staining it is well to wash film in 5% Sulphuric Acid to neutralise adhering alkali, then wash to remove acid. The search for Tubercle Bacilli is most thorough and certain.—B.M.J. ii./11,596; see also B.M.J.E. i./11 80.

**Loeffler's Modified Antiformin Method.**—To 5 to 20 Cc. of sputum add equal volume of Antiformin 50% diluted with water. Heat until clear liquid results. To 10 Cc. of the mixture add 10% Solution of Chloroform in Alcohol (5 Cc. generally suffices). After shaking centrifugalise 15 minutes An opaque layer is then formed between the Chloroform which occupies the bottom of the centrifuge and the supernatant fluid. Pipette off the latter and remove the opaque layer wholly on to a slide. Make films fix and stain. This method is said to be rapid and simple and to give good results.—L. ii/11,1747

In the diagnosis of early pulmonary tuberculosis Antiformin should always be used.—L. ii./10,1747, *q.v.* for various other modifications of the Antiformin and other methods for demonstrating Tubercle Bacillus in sputum and fæces.

May be used to determine the nature of a mild or early lesion. A piece of suspicious tissue the size of a lentil, or slightly larger, is crushed with forceps and rubbed on a slide, after nearly drying 15 or 20 %solution of Antiformin is poured on to it to cover the whole slide and placed in the incubator until the following day. The tissue is dissolved and the fluid evaporated to form crystals,—these are removed carefully by applying water. The water is removed in such a way that as little as possible of the specimen is washed out. Stain with Carbol Fuchsin.—B.M.J. i./10,1646; per D.M.W., July, 14, 10. See also B.M.J.E. i./11,68.

Another method of proceeding is as follows: —Mix Chlorinated Lime 80 with water 400, dissolve Potassium Carbonate 58 in boiling water 300 and pour the hot solution into the Chlorinated Lime mixture, shake the flask, then stopper it, set aside to cool, and add Water to 1,000. Equal parts of this and of a 15% solution of Sodium Hydroxide are used. Employ this solution on similar lines. —Jour. Med. Research, June 1910, p. 517, per Pres. May 1911, p. 148.

**Detection of Tuberculosis in fæces** by aid of Antiformin. Until recently it was thought that the discovery of *B. tuberculosis* in fæces was diagnostic of tuberculous enteritis, —the bacillus, however, frequently occurs in fæces of patients suffering from pulmonary tuberculosis.

Acid-fast bacteria resist Antiformin when diluted to 20% for 2 to 5 hours—other bacteria and organic matter generally are speedily dissolved. A small piece of fæces (about a cubic ¼ inch in size) is placed in a conical glass and to this some 20 Cc. of Antiformin diluted with Water to 15% is added and the whole well mixed. More of the diluted Antiformin is added and the mixture alllowed to stand for about an hour. A white curdy precipitate appears on mixing and settles. Beneath this white layer some unchanged fæcal matter remains and above the white layer the fluid is of a clear yellow or brownish color. A drop or two from the white curdy layer is mixed with a drop of Albumin Water and stained by the Ziehl Neelsen method. Much searching may be necessary. For certainty Alcohol may be used in addition to Acid for decolorising.—B.M.J. ii./10,184; L. ii./10,1747. *See also* B.M.J.E. i./10,36.

Combined cytological and bacteriological staining may be effected by employing the ordinary Ziehl-Neelsen method and following with Giemsa's, Jenner's and Leishman's stains.—L i./09,776.

A granular form of *B. tuberculosis* exists which does not stain by Zeihl-Neelsen method. **Much's modified Gram method** described.—B.M J.E. ii./09,44

**Gabbett's Stain.**—(i). *Fuchsin Solution.* Fuchsin 1, Absolute Alcohol 10, Phenol Solution (5%) 100. (ii.) *Methylene Blue Solution.* Methylene Blue 2, Pure Sulphuric Acid 25, Water 75. Stain 2 or 3 minutes with (i.) warm, then with (ii.) 1 or 2 mins. Wash, dry and mount in Zylol Balsam. The decolourising and contrast are done in one process.

## Albumin Reaction in Tuberculosis.

The reaction is conducted as follows:—5 Cc. of Sputum are mixed with 20 Cc. of Normal Saline in a test tube. 5 or 6 drops of Acetic Acid are added and the whole shaken up and filtered. The filtrate is then tested for albumin by heat or nitric acid. It is said to be more useful than microscopic examination for diagnosis of tuberculous disease of the lung, even in early stages when it may be difficult or impossible to find the bacilli in the sputum. A reaction for Albumin is not constantly given in miliary tuberculosis nor in pleurisy. It is present in acute lobar pneumonia due to pneumococci during the attack, also in acute pulmonary œdema; acute conjestion and acute broncho-pneumonia. As a rule it is negative in chronic bronchitis and in emphysema. In cardio-renal cases it is often positive. The intensity of the reaction in phthisis is in direct proportion to the importance and gravity of the lesions and abundance of tubercle bacilli.—L. ii./11,1084 (Clinical results with the test), 1660 (no great diagnosic value).

A positive reaction in 21 cases out of 25 sputa examined agreed with finding of the bacillus in the sputum,—in 19 of which it was present. If *only a trace of Albumin* is present add *a considerable* amount of Saline to *ensure its precipitation on boiling.*—L. ii./11,1802.

**Urine.**—At least six films should be prepared. The specimen is centrifugalised, the supernatant liquor is poured off, and the sediment is washed two or three times by shaking up with sterile water, centrifugalising on each occasion, fix film with alcohol. Stain as for sputum, but wash, after 5 above, in absolute alcohol. In taking sample wash glans penis, to ensure not getting any Smegma bacilli—the latter resists acid when decolourising, but differ from *Bacillus tuberculosis* as follows:—Easily decolourised by alcohol. The acid-fast character is but temporary, as it disappears in a few days after mounting in xylol balsam.

Russ has endeavoured to detect tubercle bacilli in urine, milk, &c., by aid of an **electrical current.** The movement of the organisms in an emulsion toward one of the poles is possibly due to chemical affinity, or to their being driven mechanically by the ions. To detect the bacilli in pathological fluid by means of a current it is necessary to add to the fluid an electrolyte in which the organisms are known to migrate. Of a number of substances tried Ethylamine was found to be best for the purpose. This produced a fair accumulation of bacilli at the kathode. The aggregation is probably due to an affinity between the products of electrolysis and the bacteria. The method has great detective capacity. Various bacteria behave differently, suggesting the possible use of the method for diagnosis.—L. ii./09, 2; B.M.J. ii./09,81.

In urinary tuberculosis (tuberculous disease of the kidney) Forsell's method modified gives best results.—Deutsch. Zeitsch, f. Chirurg-Vol., 66, 266.—B.M.J. ii./08,997.

The routine examination of urine of all patients suffering from albuminuria irrespective of whether blood or pus is present, will reveal presence of tubercle in a surprisingly large number of totally unsuspected cases.—B.M.J. ii./09, 997.

Tuberculous disease of the kidney too often goes unrecognised until a comparatively late period.

It is said that fresh urine from tubercular cases in the active stage of the disease, when heated to boiling is amphoteric to litmus. In advanced conditions it is strongly acid. If the fresh urine be treated with a little lead Acetate Solution and well filtered and a portion of the filtrate boiled, treated with a few drops of 10 to 20% Alcoholic Silver Nitrate Solution, after 5, 10 or 12 drops, the urine from cases in the first or latent stages of tuberculosis, or the second or active stage will show brick red to violet colour; that from patients in the third stage will give a dark red. Normal urine and that from cases of other diseases bacterial or otherwise will give no reaction.—P.J. ii./11 35.

**Ligroin method of Detection.**—To 5 Cc. of Sputum in a flask add 50 Cc. Caustic Potash Solution 5%. Shake and leave at room temperature until the sputum is homogenised. Dilute with 50 Cc. tap water and shake again. Add 2 Cc. Ligroin and shake until emulsion is formed. Warm to 60° C. until evidence of layer of smaller bubbles on the surface. A number of drops are then taken from immediately below this superficial layer and with a loop and placed on a warm slide. The dry film is then fixed with Saturated

Sublimate Solution and stained by Ziehl-Neelsen method.—L. ii./10,1747. The Ligroin causes the Tubercle Bacilli to rise to the surface of the meeting of the two liquids.

**Blood.**—The organism it is stated can be demonstrated in the blood of tuberculous patients by shaking, say 5 Cc. removed from a vein, with equal quantity of Normal Saline with 2% Sodium Citrate. Place in refrigerator 24 hours. Remove sediment with pipette and dry on slide with moderate heat. Place slide in distilled water until the blood is completely laked. Fix films thus made in Bunsen flame and stain. The organism has been demonstrated in all of 125 cases of tuberculosis examined.—L. i./09,703.

Opinion is divided as to the presence of the organism in the blood in tuberculosis—work at Brompton did not confirm, *vide.*—L. ii./10,1747.

The blood of 22 cases of pulmonary tuberculosis examined in all stages and two acid-fast bacilli seen—considered accidental.—B.M.J. ii./09,1119.

**Milk.**—The staining for *B. tuberculosis* is similar to that used for urine. Both the cream and the sediment must be carefully searched on centrifugalising. It is well to soak the slides at the outset after drying and fixing, in ether for a minute or two to remove the fat. *Negative results in all instances are not necessarily conclusive of absence of infection.* Injection of susceptible animals is then necessary for confirmation.

The Jubilee of Koch's discovery (25 years ago) of the Tubercle Bacillus, including note on original method of staining.—B.M.J. i./07,775.

**Acid Fast Bacteria.** In addition to *B. tuberculosis*, *B. Leprae* (*q.v.*) and the *Smegma Bacillus* which resists acid by the Zeihl-Neelsen method the following organisms give identically similar reaction.—

1. *Timothy Grass Bacillus.* Syn. *Moeller's Grass Bacillus* producing lesions closely resembling tubercles. Another variety of this organism has been found in the dust of hay lofts, and a third variety is known as the 'Mist bacillus' (Dung bacillus).

2. The *Petri-Rabinowitch Butter Bacillus* producing lesions closely allied to tuberculosis when injected into the peritoneal cavity of guinea-pigs.

Only in the case of material where outside contamination has been possible do these Bacilli '1' and '2' become an element for consideration—*i.e.*, the customary method of examination is practically of unvarying value.—Muir and Ritchie.

Acid-fast bacilli very common in chronic ear discharges (Wyatt Wingrave, Roy. Soc. Med. Otol. Sec., 1908). They have also occurred in carcinoma of stomach.—Rolleston and Higgs, B.M.J., 1907. Bacilli can be rendered acid-fast by action of fatty acids, *e.g.*, *B. subtilis*, *B. butyricus*, *Clostridia*, and *Streptothrices*).

## Serum Diagnosis of Tuberculosis.—

**Application of the Bordet-Gengou Reaction.—Determination of Specific Amboceptor** in the patient's serum in treatment with Tuberculins.

One can, according to Wassermann and Bruck, determine, by means of the complement deviation, the presence of minute quantities of bacterial matter on the one hand and of corresponding antibodies on the other. Tuberculin is mixed with the serum of patients in graduated quantities and a small quantity of fresh normal guinea-pig serum, *i.e.*, complement-containing, is added to each of these mixtures. After an hour at 37° C. a specific hæmolytic serum, previously inactivated by heat is added to each mixture, and then some red blood corpuscles, towards which the serum possesses hæmolytic properties. (The hæmolytic power of the serum must naturally have been previously determined) If there are any specific amboceptors present in the serum to be examined, they will combine on the one hand with the Tuberculin, on the other with complement of the normal guinea-pig serum, hence there will be no hæmolysis as the hæmolysing power of the specific hæmolytic serum necessitates the co-operation of the free complement.

In this way the presence of Antituberculins in the blood of tuberculous patients, at least in such cases as had been treated with specific Tuberculin preparations can be shown and the determination of the amount of antituberculin in the patient's sera gives an index of the degree of immunisation, but the amount of specific immunising bodies will doubtless vary independently in the same way as do the Opsonins. Further, in isolated cases, an observed positive complement fixation has possibly not been caused by the fixation of a specific amboceptor, but through free Tuberculin, as Tuberculin as such, at least in large doses, is in itself complement fixing. Control tests are, therefore, essential.

The reaction amounts to a modified Wasserman Test. Chemists will appreciate the following method of viewing the reaction,- "Let the Bacterium or organism be represented by Zinc Carbonate,— the complement by Sodium Sulphide $Na_2S$, the immune body by $H_2SO_4$, Sheep's corpuscles by Lead Nitrate $Pb(NO_3)_2$. Then $ZnCO_3$ and $H_2SO_4$ form a compound which combines with $Na_2S$ (forming $ZnS$ and $Na_2SO_4$. $ZnCO_3$ cannot combine without intervention of $H_2SO_4$. Now if to this mixture of bacterium ($ZnCO_3$), immune body $H_2SO_4$ and complement ($Na_2S$) some Lead Nitrate (Sheep's corpuscles) be added no Black Lead Sulphide will be formed (no hæmolysis). But if the immune body be excluded from the mixture a black precipitate will result (hæmolysis).—

$$ZnCO_3 + Na_2S + Pb(NO_3)_2 = ZnCO_3 + PbS + 2NaNO_3.$$

It will be seen the one molecule of the immune body $H_2SO_4$ absorbs 1 molecule of complement $Na_2S$ in the presence of its specific bacterium ($ZnCO_3$), and if there is more complement present than immune body some complement (Soluble Sulphide) will remain unabsorbed and will produce blackening with Lead Nitrate, and thus the trace of immune body is likely to be overlooked. In tubercle there are frequently only very small traces of immune body—usually $\frac{1}{5}$ part of the complement present.

The exact method of procedure with regard to tuberculosis cannot be given here. The directions are explicit and should be consulted. As a rule, patients with tubercle and inflammatory diseases other than tubercle hæmolyse markedly.—V. B. Nesfield, L. ii./10,1875. For application to syphilis *v.p.* **227** *et seq.*

The directions in question should be read in conjunction with the criticism of D'Este Emery to the effect that Emulsion of killed Tubercle Bacilli was found better than Tuberculin as Antigen,—the Emulsion to be accurately standardised—*e.g.*, to 4% bacillary substance. The criterion as to the strength of the reaction is the time necessary for the complete absorption of all complement when the Serum and Emulsion are mixed in certain proportions (1 : 4) and incubated—using sensitised human corpuscles. In health the absorption time is 15 to 25 minutes—in 40 tuberculous cases under 2¼ minutes. Prognosis is good when the serum contains a large amount of antibody and therefore has a **short absorption time.** Emery has seen patients improve on a shortening time and *vice versa*,—but this is not invariable. The method has advantage over the eye-destroying counting Opsonic Method.—L. i./11,56. Further notes by V. B. Nesfield.—L. i./11,126.

D'Este Emery in reply says practically all persons,—adults especially—have in their blood antibodies to the tubercle bacillus, therefore any diagnostic method must be quantitative, *e.g.*, the estimation of the time in which Complement absorption takes place with an Emulsion of Bacteria of definite strength under standard conditions. All **hæmolytic observations** on Hecht's method are liable to be vitiated by the fact that the *amount of amboceptor is subject to variations* as yet unmeasured,—this with the variation in the amount of the complement renders accurate work difficult.—L. i./11, 190.

There are two opposite factors in the process of cure of an infective disease,—on the one hand an increase in the defensive forces tending to cause immunity, and on the other, a specific raising of the sensitiveness of the body to the microbe or its toxin so that it tends to become *less* immune. The latter process is called ANAPHYLAXIS (opposed to prophylaxis). In the case of tuberculosis the first effect of a tuberculous lesion is to raise the susceptibility of all parts of the body to the tuberculous toxin This substance,—Tuberculin, is practically without action on a normal person. It is only when he is *sensitised* by a previous dose or doses that it becomes a real toxin. This process is in the highest degree disadvantageous to the patient.—the tuberculous fever when not due to secondary infection is apparently an entirely anaphylactic reaction to doses of Tuberculin too small to have any action on a healthy person. It appears however, that this stage is essential to the production of immunity. Both anaphylaxis and immunity are specific—either may serve in diagnosis. The great *majority of adults have already acquired some immunity to tuberculosis.* Children very commonly have a small tuberculous focus (94% in Vienna amongst the poor become tuberculous before reaching the age of 14) causing no apparent symptoms. Everybody is being constantly vaccinated against the Tubercle Bacillus *via* the alimentary canal and lungs. The traditional peck of dirt must contain innumerable millions of tubercle bacilli. The immunisation or preventive treatment so caused is absent to a great extent in childhood. Adults as a class show sign of having been rendered partially immune to the tubercle bacillus and this renders the diagnosis by the immunity reaction more difficult than in children.—Von Pirquet's test is entirely satisfactory in childhood but of less value in adults—W. D'Este Emery.—L i /11, p. 485.

THIS ANAPHYLAXIS OR INCREASED SUSCEPTIBILITY—the most familiar instance of which is the Serum 'disease' which sometimes occurs after injection of Diphtheria Antitoxin, according to this is an essential feature in bodily response to infection and invasion of the tissue fluids by alien Proteins or Antigens. It forms the basis of the Tuberculin Reaction, since it is only after sensitisation to these substances by previous injection, or by a preexistent lesion, that the specific reactions occur. Hyper-susceptibility is as much specific as the more obvious or protective immunity. Emery reviewed the various diagnostic methods for tubercle depending on the presence of the various antibodies and pointed out the difficulties with all. A single determination of the Opsonic Index for example is now generally admitted to be only of value if it fall considerably outside the somewhat wide limits allowed (0.8 to 1.2). The **Bordet-Gengou Reaction** (*q.v.*) is applicable if made quantitative. He modified it by determining the **absorption time** of complement by Serums in presence of the Antigen which is a standard Bacillary Emulsion, using Blood Corpuscles as indicator—absence of hæmolysis is the index of absorption of complement. In 34 cases of diseases other than tuberculosis and of healthy persons, the average absorption time was 18.1 minutes,—the maximum being 35 and the minimum 2.5. In tuberculosis the average was 7.4 minutes. Absorption times of less than 2.5 minutes were obtained in 25 out of 56 Tuberculous Serums examined. If this time be taken as the criterion the test was therefore obtained in 44.6% of tuberculous and in 8.8% of non-tuberculous.—L. i./11,564,594.

## Bacillus Typhosus.—Typhoid Fever.

Zupink divides bacteria into groups—the organisms of one group will be clumped by the serum from an animal inoculated with any of the same group, *e.g.* all acid-resisting bacilli are agglutinated by serum resulting from injecting B. tuberculosis. The fact that the agglutinating power of a serum may be exhausted by additions of the bacilli on which it acts proves that the power is in reality due to a definite substance.—Bosanquet.

**Widal's Reaction.**—Collect sample of blood in a small capillary pipette, and seal the ends, that nearest the blood being closed first. By pricking the lobe of the ear or the finger the blood will run into the tube by capillarity. The serum is allowed to separate, or the tube is centrifugalised to cause as complete a separation as possible of corpuscles which may mask a reaction. The serum is blown out on to the corner of a slide and a platinum loopful is mixed with 9 loopfuls of normal saline solution, and one loopful of this 1 in 10 dilution is mixed with two loopfuls of typhoid broth, not more than 24 hours old, preferably filtered through ordinary filter paper. This 1 in 30 dilution is now examined as a hanging drop. A control experiment must be conducted in addition.

Positive Reaction.—Complete: Clumping of organisms and cessation of movement as a rule in under 30 minutes, or may be instantaneous). Partial reaction Sluggish movement providing the control is actively motile.

Negative reaction: No alteration in 1 hour. Dilutions 1 in 100 should give same results in 50 minutes; if the time exceeds this the diagnosis is doubtful.

The reaction may also be performed in similar dilutions in sealed capillary pipettes (Wright). This constitutes the macroscopic method of applying Widal's Reaction.

Wright's improvements in the technique.—L. ii./03,214.

The urine and other excretions of typhoid patients also possess agglutinative power. It is stated that if the serum be heated to 80° C. for one hour its agglutinative power is lost.

**Notes of Caution in Applying.**—The broth itself or a control with normal serum should first be examined to see that the organisms are freely motile and show no puesdo clumps, as clumps are sometimes present in the broth before the addition of the blood. The serum of persons having previously had typhoid may react even years after. This may cause confusion where a typhoid diagnosis had not been given. Again, if only slightly diluted, *e.g.*, 1 in 10, normal serum frequently 'clumps,' which is not the case on further dilution,—1 in 30 or 50 is safest. Too *great* a dilution may obscure. The blood of *all* cases does not react, case may be too early (generally obtained about end of first week). Cases recorded where reaction intermits, absent one day, present next, and again recurs, and also a few described where there was no reaction throughout the disease, but these are fortunately very rare.—Clinical Journal, May, 2, 1900.

A special culture should always be at hand—one known to react, as occasionally laboratory cultures do not respond.

The reaction is not considered positive (at Guy's Hospital) unless clumpimg and immobility occur with a 1 in 200 dilution within half an hour.—L. i./03, 363.

A pathogenic organism other than *B. typhi abdomimalis* may give the reaction, *e.g.*, according to Durham, *Gärtners' bacillus* when mixed with typhoid broth may react. If one drop of blood serum of a patient under infection with this organism (from eating unsound meat) be mixed with 9 of typhoid broth, a positive result may be obtained, but 1 in 100 dilution is negative.—B.M.J. i./98,1797.

As to the nature and causes of the reaction, the bacilli produce in the spleen and elsewhere toxins which, by their action on the tissues, particularly on the blood, cause certain changes, apparently chemical in nature, giving to the blood and certain fluids this property of causing clumping and cessation of movement when mixed with the typhoid bacilli.—Clinical Journal, May 2, 1900.

Three positive Widal Reports resulted in a diagnosis of typhoid. One proved to be influenza with recovery in three days, the others influenza and lymphadenoma respectively—pointing to the necessity for reviewing other features of the case and the possibility that the patients had been unconsciously subjected to the influence of enteric poison in slight and merely immunising degree.—Douglas Powell L. ii./08,1125.

Blood letting in patients was speedily followed by a rise in the specific agglutinating power of their serum.—B.M.J. i./10,104.

The variability of agglutination of *B. Typhosus* and *M. Melitensis* by normal sera.—L. ii/11,877.

**Typhoid Agglutometer** for early diagnosis of typhoid fever consists of a permanent suspension of dead typhoid bacilli, with apparatus for making a Widal test directly from the blood of the patient without the aid of a microscope. No. 1 is for one test; No. 2 for 15 to 30.—L. i./05,1505.

**Serum Papers** are prepared for use in identification of this organism, as also of *B. coli*, *B. paratyphi* (*A and B*), *B. dysenteriæ* (Shiga and Flexner).

**Bordet-Gengou Reaction.** This test is claimed to be specific for typhoid. "To conduct the test a susceptible animal is injected with a culture of the typhoid bacillus. This develops amongst other bodies a bacteriolysin *i.e* the complement, naturally occurring combines with an amboceptor, produced by the liberation from certain cells of the inoculated animal of receptors having 2 affinities, one for the complement and one for the bacilli. The inoculated animal is bled and its serum is obtained after whipping the blood by centrifugalization. The serum is then heated for ½ hour at 57° C. that is 'inactivated' or deprived of complement. The complement being destroyed, free amboceptors are present in the serum, a measured quantity of which is mixed with some of the original antigen used—*i.e.*, an emulsion of Typhoid bacilli and a measured quantity of the serum of a normal guinea-pig is added. The three constituents are heated about 1 hour at 37° C. By this procedure the amboceptor is enabled to link itself by its cytophile affinity to the bacteria and by its complementophile affinity with the complement contained in such abundance in the serum of a normal guinea-pig. The complement is thus 'anchored' to the amboceptor and is no longer free to combine with any other amboceptor. To this complement another amboceptor is offered, and the inability of the complement to become anchored to another is taken as an indication of the affinity of the first-named amboceptor for *B. typhosus.*

If the inactive serum of a normal animal not immunised against *B. Typhosus* be placed in contact with these bacilli and guinea pig complement, no anchoring of the latter body will take place, and it will be free to enter into any other alliance of suitable character available.

If a rabbit be immunised by injecting it, say with washed red sheep's corpuscles —a hæmolytic serum is produced, *i.e.*, in the rabbit's serum an amboceptor is developed, which by combining with rabbit's complement on the one hand and sheep's corpuscles on the other, produces such an effect that the latter are laked, the hæmoglobin being transfused into the normal saline solution, with which a suspension of the sheep's corpuscles is made. Before exposing the rabbit's serum to the suspension of sheep's corpuscles it is heated to 57°C. In this way the rabbit's complement is destroyed and hæmolytic amboceptors left free, which though capable of combining with sheep's corpuscles, do not in such combination take the latter because no complement is available."—B.M.J. i./09,415. *Vide* also L. i./11,488 and application of the Reaction to Tuberculosis, p. **250.**

**Wassermann's Reaction** (*q.v.*) is analogous with this test

In diagnosis the agglutination reaction has been chiefly used on account of its comparative simplicity, but the fixation or deviation of complement can be and has been used in a great many different diseases to demonstrate the existence of specific anti-substances in the blood and so serve as diagnostic. Thus, *e.g.*, if a small amount of serum (heated to 55° C. to destroy the complement) from a typhoid patient added to a quantity of Emulsion of B. Typhosus the mixture will show the property of absorbing a certain amount of complement, whereas in a control with Normal Serum or with serum from another disease this absorption will not occur.—Prof. Muir, *c.f.*, *Vol. II, pp.* **230, 231.**

Recognition of small quantities of B. Typhosus by complement fixation—in the mixed growth obtained on plates inoculated with an emulsion of fæces. —B.M.J. ii./10,1516.

Diagnosis of enteric fever by the conjunctival instillation reaction.—L. i./12, 313.

Recognition of B. Typhosus.—Non-Gram staining. Length 2 to 4μ. Long and coccal forms in cultures. Actively motile flagella well seen by dark ground illumination; they may be stained by McCrorie's, Van Ermengem's, or Pitfield's methods, are long and wavy, 12 to 16 in number, though films usually do not show more than 8 to 10, a large number of detached flagella being also visible. No indol production.

The flagella actively motile can be shown by **Pollard's Method** (*vide infra*).

A permanent slight acid production in litmus milk distinguishes from *Gärtner's Bacillus* which produces marked alkalinity in all cultures (milk is not coagulated by either). Neither this, *Gärtner's Bacillus* nor *B. coli*, liquefy gelatin.

Growth on potato translucent (that of *B. coli* and *Gärtner's Bacillus* is brown and moist); in glucose-gelatin no gas formation (differences from *B. coli*, of which at least 15 species have been described, and *Gärtner's Bacillus*). The Indol test is not always specific with strains of true *B. coli.*

Caffeine enrichment method for separating *B. typhosus* from *B. coli.*—L. ii./05, 464. *B. typhosus* is said not to grow in a medium containing 0·01% Arsenious Acid, whereas *B. coli* will grow in a medium containing 1·5% of same.

## Flagella Stains.

McCrorie's Stains.—Solution A. Night blue 1 in Alcohol, absolute 20, Alum 1 in water 20, Tannic Acid 1 in water 20. Mix and filter at once. Solution B. Anilin Fuchsin. To 100 Cc. of saturated Anilin Water, add 10 Cc. of absolute alcohol and 1 Gm. of Fuchsin, or Carbol-Fuchsin diluted may be employed.

VAN ERMENGEM'S STAINS.—A. 1% Osmic Acid Solution 100, Tannin 18, Water 45. B. Silver Nitrate Solution 0.25 to 0.5%. C. Gallic Acid 1, Tannin 0.6, Potassium Acetate fused 2, Water 70

PITFIELD'S METHOD.—Solution A. Tannin 1, Gm. Water 10 C c. Do not filter. Solution B. Saturated aqueous solution of Alum 10 Cc., saturated Alcoholic Gentian Violet Solution 1 Cc. Filter and keep in a stoppered bottle. Fuchsin will answer the same purpose as Gentian Violet. Equal parts of A and B mixed, heated to nearly boiling and employed to stain 1 to 3 minutes, wash in water, dry and mount.

POLLARD'S METHOD.—Young agar cultures not more than 24 hours old of a motile micro-organism are employed. An emulsion is made in about 8 Cc. of tap (not distilled) water. Six drops of fresh 5% Tannin Solution are added. After ¾ hour a turbidity will be noticed. Shake gently and examine 'hanging-drop' with 1/12 inch objective, this shows the organism with flagella attached, especially round the edge of the drop. Numerous active detached flagella are also visible.

These preparations may be dried and stained by (i.) Simple stain, *e.g.*, Carbol fuchsin or methylene blue ; (ii.) Ziehl Neelsen's method. Good results can be obtained with cultures even a year old, in the latter case, however, the organisms are generally non-motile.

*Differentiation of B. Typhosus from B. Coli and other similar organisms*:—

*Gärtner's Bacillus* thought to be a modification of *B. coli*, and the above differences not always constant, and even the agglutination test between *B. typhi abdominalis* and *B. coli* not always reliable. Stab and stroke cultures on agar containing 0.3% glucose, stained with neutral red, distinguish *B. coli*, discharging it probably because it is a strong reducing agent, producing a saffron tint with fluorescence in 12 to 24 hours, but *B. typhi abdominalis* is without action on the red tint.—L. i./01,613 ; P.J. i./01,391.

*B. coli communis* is a normal and advantageous inhabitant of the intestine, but may become responsible for an attack of inflammation of the bowel or epidemics of food poisoning.—P.J. ii./03,740.

**"Krystall Violet"** and neutral red, advocated for distinguishing colonies of *B. coli* (coloured red) from those of *B. typhi abdominalis* (also *B. enteritidis Gaertner* and others), coloured blue to purple. Medium contains Sodium taurocholate to inhibit growth of nearly all but intestinal bacteria. Lactose is another essential component of the medium, as *B. coli* and congeners decompose it with gas formation.—B.M.J. i./02,1473.

Portions of suspicious tumours removed and sections of same cut by rapid histological method and examined. The sections from the microtome are fixed and stained by a drop of acetone solution of Krystall Violet.—B.M.J. i./09,1226.

Conradi evolved a method of early diagnosis of typhoid fever. Researches demonstrated necessity of keeping the blood in a fluid condition, so as to avoid the disinfectant action of those substances which become active on coagulation. Bile is employed for this purpose ; in addition, the medium contains 10% peptone and 10% glycerin. The blood from lobe of the ear is drawn into a pipette containing a little bile and mixed with two or three Cc. of the Peptone-glycerin-bile medium in the proportion : blood 1, medium 3. Incubate at 37° C. for 10 to 16 hours and make cultures on agar plates according to the Drigalski-Conradi formula. Diagnosis can be effected by this method in 26 to 32 hours and it is applicable as soon as the patient exhibits a febrile temperature.—B.M.J. i./06,339.

*Conradi's Medium* (Brilliant Green Picric). Agar 30 Gm., Liebig's Extract 20 Gm., Peptone 10 Gm., Water 1,000 Cc. Normal Soda or Phosphoric Acid Solutions added until the reaction is +30 Eyre's scale, Phenolphthalein being used as indicator. After sterilising, 1 Cc. of 1 in 1,000 Solution Brilliant Green "extra pure," and 1 Cc. of 1% Picric Acid Solution are added to 150 Cc. of the medium. These dyes are stated to give the best results. The typhoid colonies (after inoculation with dejecta) after 20 hours at 37° C. appear smooth-edged, round almost flat. May be immediately identified by observing agglutinative effect of an anti-typhoid serum on them. Cultures on the medium —B.M.J. ii./08,1444.

**China Green** (WERBITZKI) *i.e.*, 3% Agar neutralised to +13 on Eyre's Scale with 1.4 to 1.5 Cc. of a 0.2% China Green Solution added to each 100 Cc.,—*i.e.*, 0.003 Gm. of China Green in 100 Cc. of the medium. Suppresses about 75% of *B. coli* colonies, the typhoid colonies on the other hand grow luxuriantly.—L. ii./09,465 ; B.M.J. ii./09,329,866.

This medium is recommended for detection of typhoid bacilli in stools.

The Coli colonies that develop are small, opaque and point-like whilst the typhoid colonies are larger and darker in the centre. The period at which the patient ceases to pass bacilli is very variable.—L. i./11,657.

With regard to persistence of this and other organisms in London water see p. **265**.

Persistence of typhoid bacilli in the kidney after apparent recovery from typhoid—and the Widal reaction also given.—B.M.J. ii./07,75.

The bacillus could be recovered from bottles intentionally infected with it, in course of an investigation on best mode of disinfecting water for military use, even after washing out 12 times with sterile water.—B.M.J. ii./07,518.

Sunlight (in India) reduced 240,000 typhoid organisms in ½ hour to 1,000, in 1 hour to 5, and in 2 hours to nil.—L.i./09,742.

VITALITY OF B. TYPHOSUS.—There is considerable difference between the vitality of the organism when grown on artificial culture media and the capacity of the same bacillus for survival under natural conditions. The culture bacilli possess much greater vitality than organisms obtained directly from excreta.—B.M.J. ii./09,482.

MAY GRUNWALD'S SOLUTION is a Methylene Blue—Eosin Mixture similar to Jenner's Stain for typhoid diagnosis.—B.M.J. ii./06,1848 ; B.M.J.E. ii./06, 77.

*B. paratyphosus of Brian and Kayser. Paratyphoid* in the tropics (Ceylon). The disease is indistinguishable from Typhoid, though generally running a milder course. Intestinal ulcers are identical with those of Typhoid. Cases of mixed infection are not rare.—L. i./07,284.

Importance of associating mild cases of typhoid with this.—L. i./07,1293.

Two cases of Para-typhoid.—L. i./07,1571.

Distribution of certain bacilli of the food-poisoning group (*B. Suipestifer* and *B. Paratyphoid* ('*B.*')) more limited in England than abroad.—B.M.J. ii./10,1503.

Variation among bacteria. The author describes a bacillus which was isolated from a former typhoid carrier, and which formed acid but no gas in glucose media, and which fermented lactose at 22° C. but not at 37° C. In not developing gas in glucose media, but forming some Mannite it resembles certain Colon Bacilli of the "anærogenes" class which form connecting links between *B. Coli* and *B. Typhosus* group of micro-organisms.—B.M.J. ii./10,1909.

**Fermentation Reactions of B. Typhosus.** Investigations gave the following conclusions :—

(1) The fermentation reactions of B. Typhosus are identical up to the 4th day. (2). B. typhosus ferments glucose, mannitol, galactose, and sorbitol with the formation of acid within 24 hours. Dulcitol and arabinose are fermented more slowly, acid being produced usually during the second or third week. Lactose, saccharose, dextrin, inulin, amygdalin, salicin, raffinose, erythritol and adonitol are not fermented. Gas is never produced by B. typhosus. Litmus milk is turned faintly acid generally within 24 hours, and remains thus permanently. (3). The time taken to ferment dulcitol or arabinose varies widely even in the same culture tested repeatedly, and also amongst daughter colonies from a single-plated culture. (4). The time taken by a given strain of B. typhosus to ferment dulcitol or arabinose is very markedly quickened for that strain by a sojourn in media containing dulcitol or arabinose respectively. (5). Within certain limits the increase in (dulcitol) fermenting powers varies with the length of sojourn in dulcitol-containing medium. (6). The increased activity as regards fermentation of dulcitol persists through several generations of agar cultures, but eventually tends to die out. It also persists on stored agar cultures for over a month if this culture be sub-cultivated and tested. (7). No other modifications either as regards agglutination, fermentation reactions or cultural characteristics are seen in the agar cultures after passage through dulcitol (or arabinose) containing media other than the increased activity towards the corresponding "sugar." The cultures after passage through dulcitol become "dulcitol active," and after passage through arabinose "arabinose active." The "dulcitol active" cultures do not show any increased activity towards Arabinose, nor do the "Arabinose active" cultures show any in-

creased activity towards dulcitol. (8). Mere passage through peptone water or through other sugars, *e.g.*, mannitol, lactose, or saccharose—does not increase the fermentative activity towards dulcitol or arabinose. (9). It was not found possible to make B. typhosus ferment lactose or saccharose. (10). By means of passage through appropriate sugars it was found possible to develop two modifications of an anærogenic coliform organism each active towards a new sugar not easily affected by the original strain. (11). The fermentation activity of B. typhosus, while one of remarkable constancy in quality, can be increased in quantity and suggests that certain work of classification amongst colon organisms requires reconsideration.—Bradley, P.R.S.M., Dec. 1910

W. J Penfold dealing with fermentation of Lactose Peptone Water and of Dulcite Water by B.Typhosus, states it does not ferment Arabinose. Fermentation of Glycerin and papillæ formation on Isodulcite.—B.M.J. ii./10,1672.

**B. Enteritidis Sporogenes.**—An anaerobic organism staining by Gram's method, spores only on blood serum (?), which it liquefies. Note on, found in the dejecta of the sufferers in the epidemic of diarrhœa at Bartholomew's Hospital in 1895. Detection of in water supplies.—P.J. i./02,25. *Vide* also p. **266**.

Said to be the cause of infantile diarrhœa. Growth in milk produces characteristic separation of stringy curd and excessive whey. Extremely pathogenic to guinea-pigs from which pure cultures obtainable from the œdema fluid by growing on blood serum under anærobic condition, *c.f.* Water Examination.

*B. Enteritidis Gaertner* (Gram—) the cause of outbreak of meat poisoning at Limerick which produced 9 deaths. The outbreak indicates danger of private slaughter-houses and lack of supervision ; secondly, the necessity of thorough boiling of economically 'left-over' pieces of meat, especially beef, if they have to be 'used up.'—B.M.J. i./09,1171.

Paratyphoid and Meat Poisoning,—F. A. Bainbridge,Lecture I, L. i/12.705 ; Lecture II,L i./12,771 ; Lecture III, L. i./12,849.

**Bacillus Vaginæ, Döderlein's.**—

An aerobic organism, Non-Gram staining constantly found in the normal vaginal secretion in adults. Facultative anaerobe, non-motile, non-pathogenic.—Gould.

In a series of examinations of the vaginal secretion in infants this organism was absent. In more than half the cases (ranging from 30 minutes old to 13 days) the fluid was sterile. The reaction of the secretion is (normally) acid in the majority of cases,—not due to action of micro-organisms. Amongst the organisms found were a yellow Staphylococcus liquefying gelatin and white Staphylococci not liquefying.—P.R.S.M. Obst. Sect. Nov. 10, 26.

*B. Vaginae* is the only definite micro-organism of the vagina. It plays the important role of preventing the development of other micro-organisms, especially those of a pathogenic kind by the production of Lactic Acid.—B.M.J. ii./10,1222.

**Yellow Fever.**—The germ of yellow fever is generally believed to be a protozoon. ultra-microscopic—therefore not recognisable with present means. —L. ii./10,1527. Infection of the disease is probably carried by *Stegomyia fasciata*. *Filaria Bancrofti* has also been regarded as the specific germ—it has its permanent host in the mosquito, undergoing sexual reproduction in the human blood—the exact reverse of what takes place in malaria—in which man is the permanent host, the germs of yellow fever must, therefore be searched for in the mosquito. A bacillus, designated the *Bacillus icteroides*, has been found in the disease, but this is not the important feature.

The infected insect lives a long time, and it can transfer the fever as long as it lives—59 days has been recorded. It hibernates in the United States ; but, if the infected adult insects hibernate, either a very large proportion of them die or else the infecting parasite must generally die in the mosquito—the first seems probable.

The cycle of the yellow fever parasite in the mosquito before it is communicable to man is about 14 days. *C.f.* also B.M.J. i./05,552.

Proof of endemic origin of yellow fever in West Africa. It is claimed that the final proof that remittent and bilious remittent fevers are in many instances the mild forms of yellow fever will be given when by the destruction of Stegomyia these fevers will disappear in great part with yellow fever.—Sir Robert W. Boyce.—B.M.J. ii./10,1771.

History of Yellow fever,—it is endemic amongst natives of the coast towns. Rational precautions of segregation and Stegomyia destruction necessary to prevent great set backs to commercial progress in West Africa. Evidence is overwhelming in favour of the disease being endemic on the West Coast of Africa, and of its having been repeatedly mistaken for other diseases (often called "bilious remittent fever") or entirely overlooked, and of its being kept up in a mild form by the natives and infected by *Stegomyia*.—B.M.J. i./11, 491,249,301.

YELLOW FEVER ON WEST COAST OF AFRICA, DISCUSSION ON.

If not a natural immunity, many natives have at least an acquired one,—probably through mild and frequent attacks sustained in childhood. The endemicity considered by many as an established fact. Cases are described of "whites" usually having some slight "disorder" on their first visit to places endemic to yellow fever, many factors point to this "disorder" being a mild form of yellow fever, which would account for the immunity enjoyed afterwards by these people.—B.M.J. ii./11,1263 : L. ii./11,459. Etiology of., L. i./12,183.

**Whooping Cough.**—**Bordet's Bacillus.**—A cocco-bacillus, non-motile, Gram-negative, staining feebly, regarded as causative of whooping cough, has been isolated. Cultures of the organism were found to be specifically agglutinated by the serum of children suffering from. Agglutinating reacting of the serum is not strong.—B.M.J. ii./09,323,1062 (complete paper) ; L. ii./09, 471. See also Vol I. p. 943 and Therapeutic Index.

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**Gram's method of differentiating Organisms in Film Preparations:** —

1. Anilin-Gentian-Violet 3—5 mins. 2. Without washing, Gram's solution ½ to 1 min. 3. Pour off Gram's solution, wash in water, rinse with alcohol, until no further colour comes away Counterstain with neutral red 0.5% or weak Carbol-Fuchsin ½ minute. 4. Wash in water. Dry. Mount in xylol balsam. 4a. If pus, after washing in water counter-stain with Eosin 1 min. Wash. Dry. Mount.

**Gram-Eosin Method for Sections.**—1. Place a little alcohol on section ½ min. 2. Cover with filtered Anilin-Gentian-Violet 10 mins. 3. Gram's solution, 3 mins. 4. Decolourise in Alcohol. Wash in water. 5. Stain with Eosin 1—2 mins. Wash in water. 6 Dehydrate with Alcohol. 7. Clear with Xylol, mount in Xylol Balsam.

**Eosin-Gram-Weigert-method.**—Eosin (5% aqueous) 5 to 10 mins. Wash in water. Anilin-Gentian-Violet 10 minutes without washing. Gram's iodine solution, 3 minutes. Wash in water. Blot, dehydrate, and decolourise in anilin oil until pink colour returns. Clarify in Xylol and mount in Xylol Balsam. This method is preferable to the Gram-Eosin method, as anilin oil is more gentle in decolorising action than the alcohol used in the latter.

A simple stain for sections is :—

**Fleming's Triple Stain modified.** (A true triple stain).—Fix sections in Acetic Alcohol (Glacial Acetic Acid 1, Alcohol Absolute 2), cut and mount, stain 1 hour in saturated Aqueous Safranin Solution, wash in water, stain ½ hour in saturated Aqueous Methyl Violet. Wash in water and wipe all but section dry, flood the slide with solution ; to 20 Cc. of Acetone add drop by drop saturated Aqueous Solution of Orange G. until flocculent precipitate is just dissolved filter. Flood again with the stain when faint brownish pink, pour off the Orange Acetone, wash in Acetone a few seconds and then repeatedly in Xylol Finally mount in Xylol Balsam.—L. i./06,221.

**Carbol Thionin Blue.**—Thionin Blue, 0.65 Gm. ; Absolute Alcohol, 3.5 Cc. ; Phenol Solution, 5% 39 Cc.

**Gram's Iodine solution** has the formula :—Iodine, 1 Gm. ; Potassium Iodide, 2 Gm. ; Water, 300 Cc.

NOTE.—**Anilin-Gentian-Violet** is prepared by adding 1 part of a concentrated alcoholic solution of the dye to 9 parts of a filtered saturated solution of anilin oil in water (solubility about 1 in 30). P.G.V. directs 7 Cc. of the

Saturated Alcoholic Solution of Gentian Violet with a further 10 Cc. of Absolute Alcohol to be added to 100 Cc. of filtered Anilin-Water. This may overcome muddiness.'

**Carbol-Gentian-Violet** is the same with 5% phenol solution in place of anilin water.

Gram Staining. Anilin dyes exhibiting the most powerful lethal action on a typically Gram + staining micro-organism (Staphylococcus) are those which can be used with the greatest success by the method. Substances having special affinity for the dyes in question are assumed to be present in Gram + staining organisms and as Iodine plays a special role in the Gram reaction, special examinations with *lipoid* substances gave interesting data. (1) Treatment of *B. Coli* with Lecithin Emulsion may make it Gram + staining. Boiling Staphylococci with Ether renders them almost entirely non-Gram staining.—Jl. Path. & Bact.—July 1911, p. 146.

We found that non-Gram staining organisms were decolorised in periods varying from 2 to 5 minims, *using strong Methylated Spirit*, and that Gram staining organisms were not decolorised even after one hour's washing. If weaker spirit, *e.g.*, 60%, is used, organisms that were not decolorised in an hour with stromg spirit may be almost decolorised in ten minutes, therefore the *strongest Spirit is absolutely necessary.* The Iodine treatment should be for at least 5 minutes, in fact it cannot be overdone in a film preparation. We should recommend 10 minutes washing with the Spirit.

**List of some pathogenic and common non-pathogenic organisms stained and not stained by Gram's method:—**

A. Stained ('+').

- Staphylococcus, all varieties.
- Streptococcus pyogenes.
- Micrococcus tetragenus.
- Fraenkel's pneumococcus.
- Bacillus anthracis.
  - ,, botulinus.
  - ,, diphtheriæ (Klebs-Löffler).
  - ,, enteritidis (Klein).
  - ,, Oppler-Boas.
  - ,, pseudo-diphtheriæ.
  - ,, xerosis.
  - ,, tuberculosis.
  - ,, lepræ.
  - ,, subtilis.
  - ,, Welchii.
  - ,, tetani.
- Aspergillus.
- Sarcinæ, all varieties.
- Yeasts (Blastomycetes).
- Ringworm Fungi.
- Streptothrix of Actinomycosis.
  - ,, of Madura disease.

B. Not Stained ('—').

- Gonococcus.
- Diplococcus intracellularis meningitidis (Weichselbaum).
- Diplococcus Catarrhalis.
- Bacillus mallei.
  - ,, typhi abdominalis.
  - ,, coli communis.
  - ,, dysenteriæ.
  - ,, enteritidis (Gärtner).
  - ,, pestis.
  - ,, pyocyaneus.
  - ,, influenzæ.
  - ,, Friedländer's Pneumo.
  - ,, of Malignant œdema.
  - ,, of Symptomatic anthrax (Charbon).
  - ,, prodigiosus.
  - ,, proteus vulgaris.
  - ,, fluorescens liq. and non-liq.
  - ,, Smegmæ.
- Spirillum choleræ Asiatic.
  - ,, Metchnikovi.
  - ,, Finkler and Prior.
- Spirochetes of Syphilis, Relapsing Fever, Vincent's Angina, and other parasitic protozoa.

**Nitrobacterin.**—Nitrifying bacteria on the nodules of leguminous plants (peas, beans, clover, &c.) are cultivated under this name for enriching soil. The sequence of crops is turnips, barley, clover, wheat. Practice has been ahead of science. Some other valuable and concise information as to the bacteriology of fermentation, caseination, &c.—B.M.J. ii./07,1764.

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**Semen Test.**—The presence of spermatozoa may be detected by evaporating a drop of the liquid from the moistened stains, fixing it by a flame and staining with eosin and methyl green. At the base of the head of the spermatozoon is a hemispherical portion which stains green, while the anterior part and tail stain red. Some prefer the use of methyl green alone Ehrlich's Hæmatoxylin (stain 5 minutes) wash in distilled water, then in tap water until blue, and counterstain with Eosin solution (2 or 3 minutes), also gives good results.

**Semen Stains** may be identified by boiling (fabrics) 2 minutes in a watery solution containing Tannin ½% and Sulphuric Acid 1 per 1,000, then wash with strong Ammonia Solution 1 in 400 for 2 minutes, immerse 5 minutes in a solution of potassium bichromate 1 in 10,000 with 1 in 1,000 Sulphuric Acid, transfer for 2 minutes to 2% Potassium Cyanide Solution; finally rapidly wash in distilled water. Scrape and tease up on a slide, dry, fix and stain.—B.M.J. ii /06,1261,1843.

**Semen Stained by Eosin.**—Cut a portion of the cloth 1 × 1¼ inch, soak in Müller's Fluid 24 hours preferably at 37° C. in incubator (*e.g.* in covered watch glass). Wash in several changes of water to remove dirt as also fixing fluid. Place the cloth, one end held in forceps, for a moment on blotting paper to remove excess of moisture, then lay flat on centre of micro slide. Pass edge of scalpel or of another slide with a fair amount of pressure from the end of the cloth fixed by the forceps, to the other. Repeat on the other surface, turning the cloth over on the same portion of the slide. The end of the cloth is then placed, with the forceps between finger and thumb, the rest being pleated up by the same means and tucked in so that firm pressure of the tips of forefinger and thumb causes a drop of liquid to fall which add also to the slide. Dry in incubator and stain three minutes with 1% Eosin solution.—B.M.J. ii./08,501.

**Picric Acid Test for.**—Mix the suspected semen, whether liquid or dry, with a little water, add a drop of Glycero-Solution of Picric Acid containing a little alcohol—if human semen, yellow needle crystals visible under the microscope.—M. 1906.

## Preparation of Sections before Staining.

**Rapid Paraffin method** for small pieces of tissue. Fix in Alcohol two hours, Acetone 1 hour, Anilin Oil ½ hour, Xylol ½ hour in the Incubator at 37° C.—then in Paraffin at ½ hour 70° C.

**Slow Paraffin method.**—Fix in Alcohol (not Formalin) 2 days, then place in Xylol 3 to 5 days.

N.B.—Tissues fixed in Formalin or Müller's Fluid must be thoroughly soaked or the sections will not adhere to slides. Use fresh (unused) Paraffin for embedding. To fix frozen sections to slide damp off excess of water with filter paper, flood three times with Alcohol, then once with 0.5% Celloidin in Acetone. Then stain.—Wyatt Wingrave.

**Rapid Gum-freezing.**—Place tissue into boiling Müller's Fluid or Formol-Müller. Boil 3 minutes, wash in water; freeze in Gum with Ethyl Chloride.

An accessory for freezing microtomes.—L. i./05,1505.

**Formol-Müller Fluid.**—Müller's Fluid 100, Formalin 5.

**Erlitzki's Fluid.**—Potassium Bichromate 5. Copper Sulphate 1, Distilled Water 100,—used in the same way as Müller's Fluid. Microscopical examination of the eye, Method and formulæ.—Oph. 1911, 781, 842

**Transparent method** for bony specimens.

Dehydrate in successive baths of Alcohol and Acetone, Anilin Oil, Xylol, and Liquid Paraffin.

**Formalin Preservative Solution.** — Formalin (40%) 78, Potassium Acetate 3, Potassium Nitrate 1, Glycerin 40, Water 140.

This has the advantage of retaining the colour of pathological specimens.

Method of cutting frozen sections of fresh tissues for immediate microscopic diagnosis during operations. Lockwood & Shaw.—B.M.J. i./07,127.

A solution for fixing and **preserving plants** and animals in their natural colours is prepared as follows:—

Dissolve Alum 100, Sodium Chloride 25, Potassium Nitrate 12, Potassium Carbonate 60 and Arsenic Trioxide 10, in boiling water 3,000. To this solution add Glycerin 1,200 and Methyl Alcohol 300.—P.J. ii./11,442.

**Frost's Solution** for preserving anatomical specimens. Sodium Fluoride 80, Chloral Hydrate 80, Potassium Acetate 160, Cane Sugar 3,500 Saturated Thymol Water 8,000. The specimens retain life-like appearance L. i./12,579.

**Farrant's mounting medium.**—Gum Acacia, best small, 32 ozs., wash well with 6 ozs. of water in two or three lots and dissolve in 40 ozs. of boiling water with constant stirring. Strain through muslin and add Arsenious Acid 1 drachm in Glycerin 40 ozs., heat gently to clarify.

**Apathy's Gum Syrup. For ringing Slides.**—Picked Gum Arabic, Cane Sugar (ordinary, not candied), Distilled water, of each 50 Gm. Solve in water, and add 0.05 Gm. Thymol. Render alkaline with a little Sodium Carbonate. This sets in about 15 to 30 minutes in a warm room. The use of this, with other precautions, helps in preventing slides from fading.—L. i./11,877.

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## PREPARATION OF CULTURE-MEDIA.

Here may be mentioned the formulæ for preparing the commoner sterile bacteriological nutrient media.

**Nutrient Broth.**—The method preferable is:—Beef (or horse, &c., flesh) 450 Gm. freed from fat and minced, is extracted for twenty-four hours with cold water 1,000 Cc. The albumin is coagulated by heat and strained off. The resulting extract is boiled ten minutes with sodium chloride 5 Gm., and peptone (in powder) 10 Gm., with occasional shaking. Make faintly alkaline with dilute sodium carbonate solution, using litmus as indicator, and filter.

For filtering all media use a special tough thin French-grey paper. All media are used either neutral or faintly alkaline to litmus.

In place of above, a good meat extract may be used as the starting-point. Boil 5 Gm. of the extract, peptone 10 Gm., sodium chloride 5 Gm., water 1,000 Cc., and finish as above. The broth thus prepared may be run into specially cleaned test-tubes, about 5 Cc. into each. These are now plugged and sterilised at 100° C. for a quarter of an hour on three successive days, or the broth may be converted into other nutrient media.

**Standardisation.**—The broth and the gelatin and agar media made from it are acid to phenolphthalein, but are frequently neutral or even alkaline to litmus—this latter not being sensitive to many of the weak organic acids present in the meat extract. The medium is, therefore, standardised with $\frac{N}{10}$ soda in the presence of phenolphthalein. The re-action of a medium is usually expressed by the number of Cc. of normal alkali required to be added to 1 litre of medium to render it exactly neutral to phenolphthalein, *e.g.*, '+ 10' indicates that 10 Cc. of N soda have to be added to neutralise it. *This reaction has been found best for general bacterial growth, and is the standard employed.* The rule for standardising, therefore, is to subtract 10 from the number of Cc. of normal soda that must be added per litre; for example, if 10 Cc. of a medium require 1·2 Cc. of $\frac{N}{10}$ soda, then 1,000 Cc. = 12 Cc. $\frac{N}{1}$ soda. The medium is now neutral to phenolphthalein, but distinctly alkaline to litmus. Then subtracting 10 Cc. from 12 we have 2 Cc. of $\frac{N}{1}$ soda to be added to 1 litre of medium.

**Glucose Broth** consists of the above with the addition of 1 or 2% of pure anhydrous glucose added after final filtration, but prior to sterilisation.

A simple method of cultivating anaërobic organisms.—L. ii./03,1023.

**Glycerin Broth.**—Nutrient Broth containing 5 to 8 per cent. of Glycerin.

**Litmus Broth** consists of the addition of a sufficient quantity of Litmus solution to neutral broth to render it distinctly blue in colour.

**Nutrient Gelatin.**—Broth 1,000 Cc., gelatin 125 Gm. Melt in steamer, and clarify by adding the white of one egg, to which a little water may have been added, render faintly alkaline, place in steamer to make quite hot, and filter in the same, leaving the portion containing the coagulated albumin, which will have subsided, carefully until the last. Run the medium into tubes, about 5 or 8 Cc. into each according as to whether 'slopes' or 'stab' preparations are required. Sterilise on three successive days.

**Glucose Gelatin** consists of nutrient gelatin to which 1 or 2% glucose has been added after filtration. For the cultivation of anaërobic organisms and to observe gas formation. Must not be sterilised in the autoclave.

**Nutrient Agar.**—For this medium the following gives satisfactory results:—Nutrient broth 1,000 Cc., powdered agar-agar 20 Gm. (passed through a drug-mill and made as fine as possible); melt in the steamer, or better in an autoclave, allow to cool slightly, or, if time is an object, cool by shaking under a stream of cold water from the tap; add white of two eggs, *make just alkaline*, boil in the steamer or autoclave twenty minutes, and then transfer to a tall beaker; allow to get quite cold, remove the solid mass from the beaker, and cut off the bottom of the block of jelly containing the coagulated albumin and sediment. The remainder is again thoroughly melted in the autoclave or steamer, and will then filter well (in the steamer). It may be poured into tubes, and sterilised in the autoclave for a quarter of an hour under a pressure of at least two atmospheres—or, in the steamer on three successive days. Instead of cutting off the sediment on setting, it may be kept out by straining the hot liquid through butter-cloth previous to filtration.

N.B.—The white of egg should be added when the medium has almost set—*i.e.*, as cool as possible—as the albumen coagulates at 65° C. and it acts purely mechanically by carrying down with it the particles of suspended matter.

**Blood Agar** is prepared by streaking nutrient agar with blood drawn under the strictest aseptic precautions from the finger, or from a freshly-killed animal. It may be used in the 'slope' form or as plates. Neisser's gonococcus grows favourably on this medium.—N.B.—For Gonococci and Pneumococci use the patient's blood if possible.

**Glucose Agar** consists of nutrient agar to which 1 or 2% glucose has been added after filtration. In the upright form is used also for deep stab cultivations of anaërobic bacteria. Must not be sterilised in the autoclave.

**Glycerin Agar** is nutrient agar with the addition of 5 to 8% of glycerin. Is a satisfactory medium for the growth of *Bacillus diphtheriæ*, *B. tuberculosis* and *Streptothrix actinomycosis.*

**Maltose Agar.**—Maltose 12, Peptone (in powder) 3, Agar 3·9, Water 300. This is prepared in the customary manner, but the product is not neutralised. Blaxall's formula is Maltose 12, Peptone 1½, Agar 9, Water 300. For ringworm cultivation.

**Peptone-water.**—Peptone 5 Gm., sodium chloride 10 Gm., tap water 1,000 Cc.; boil in the steamer one hour, filter, and sterilise. Not necessary to render alkaline. Used for the production of the indol reaction as one of the aids, for example, to distinction (?) of *B. typhi abdominalis* and *B. coli.* It was originally utilised for cholera-diagnosis. It is Dunham's solution.

**Potato.**—Large specimens are thoroughly cleaned and cut into 'half-cylinders' with a potato-borer. The brown peel is removed and the pieces soaked overnight in water to wash off excess of starch. Wide test-tubes (1 inch by 6 inches) are plugged and sterilised, and a little distilled water is placed with each half-cylinder in the tubes. The water prevents drying up in sterilising, which is effected by heating on three successive days. Must not be sterilised in the autoclave.

Potatoes prepared as above may be soaked in 5% glycerin water for several hours previous to putting into tubes. These are very useful for the cultivation of the tubercle bacillus.

**Milk.**—The cream is skimmed from good cows' milk, and the resulting 'skimmed' milk sterilised in the steamer for ½ hour on three successive days.

May also be drawn direct by means of a catheter into sterile vessels with the strictest aseptic precautions. Organisms are said to grow better in this than in milk which has been heated.

**Litmus Milk.**—The above—with a small proportion of Litmus solution added. Used for detection of acid formation.

**Milk Agar and Milk Broth** used for the Gonococcus.

**Blood-serum.**—The serum is separated from fresh blood obtained from the jugular vein of the sheep. It is centrifugalised and filtered through a sterile Chamberland filter. (The candle is heated in a muffle-furnace, or in a bright fire, if it has been previously used for the same purpose). The filtrate may then be poured into sterile test-tubes, plugged—and inspissated, first at 80° C., then at 60° C., and the latter temperature is maintained eight to twelve hours, or more if necessary. The medium is finally tested after capping by incubating at 37° C. for twenty-four hours to ensure sterility.

**Löffler's Blood Serum.**——This consists of ordinary 'Serum' 3 parts mixed with neutral peptone bouillon 1 part with 1% grape sugar added to it. Tubes are filled and sterilised as under Blood Serum.

**Urine, Whey, Wort, Hay Infusion, Artificial Lacto-Serum.**—P.J. ii./05,274,518.

## EMBALMING.

If it is impossible to make the autopsy at once, preservative may be injected into the body until such time as convenient; about 300 Cc. of 5% solution of **Formalin** suffice. It is introduced through the arteries (arterial embalming) or a coarse trocar and cannula may be driven deeply into the tissue and the cavities and organs injected (cavity embalming).

**Perchloride Embalming.**—The former method is usually practised by opening one of the large superficial arteries, as the femoral, and forcing the fluid through the vessels. Nauwerck uses the following—500 Cc. injection syringe; long cannulæ of different calibres, with pear shaped ends and with stopcocks or, preferably, with double stopcocks; strong twine; scalpels, scissors, forceps, grooved director, hæmostats, an aneurism-needle, and ordinary needles; basins and buckets; several packages of absorbent cotton; cloths and sponges; and 10 litres of a 10% solution of mercuric chloride. His method of embalming is begun by exposing the lower part of the abdominal aorta and the two iliac arteries. Two ligatures are placed beneath the aorta, about two finger-breadths apart, and the aorta is obliquely incised to allow the entrance of the cannula, which is secured by tying the distal ligature over it. The injection into the upper part of the body is then begun carefully and slowly, pausing occasionally when the counter-pressure becomes too great. About 3 litres are injected or less, depending upon the appearance of swelling of the face, seen first about the eyes and chin. The cannula is removed, both proximal and distal ligatures are tied, and the aorta is cut through. In like manner a litre of the solution is injected into each leg through the common iliac artery. A cannula with a double stopcock can be used to inject both the upper and lower parts of the body at the same time. The mesentery is ligatured, and the intestines, from the beginning of the jejunum to the end of the sigmoid flexure, are removed, opened, washed out, and put in a 1% solution of mercuric chloride, and later replaced in the abdominal cavity, wrapped in sublimate wool, or where practicable, disposed of by cremation. The stomach, duodenum and rectum are cleaned out with sublimate solution and packed with sublimate wool. The bladder, vagina, external ear, and nose are similarly treated. The abdominal cavity is carefully wiped with a cloth wrung out of the perchloride solution and dried, and the abdominal incision is sewn up. The surface of the body, with the exception of the hair, is also wiped with the solution and dried. If this method fails, Nauwerck injects into the carotid and axillary arteries.

**Formalised Arsenical Embalming Injection.**—Hewson recommends the following injection for embalming—Sodium Arsenate 40, boiling water 157. Boil until dissolved and add glycerin 40, formalin 2 or 3. About 2 and one-half gallons are introduced into an artery—say the common carotoid—by gravity, openings having been previously made in the toes or in several of the veins if they be distended with blood. After the injection the body is thoroughly greased, covered with paper, bandaged and placed in cold storage until wanted for dissection. *Caution.*—These solutions are caustic in action on the hands.—Cattell's Post-Mortem Pathology.

## WATER.

### Bacteriological Examination.

**Collection of Sample.**—Collect the specimen in a sterile Winchester quart glass bottle with strictest precautions.

If from a water-supply, the water should be allowed to run at least half an hour before collecting, if from a reservoir or stream, surface water must be avoided by holding the Winchester at least one foot below the surface.

For comparative purposes it is important to know whether the water, *e.g.*, a well, has been recently disturbed by cleaning out or pumping. Also to examine as quickly as possible after collection of the specimen, particularly in the hot whaeter. To prevent increase in number of bacteria it is customary to pack the bottle in ice for transmission by rail, &c., to inhibit multiplication of the organisms.

**Enumeration of Bacteria.**—Agar and gelatin plates are prepared with varying quantities of the specimen, *e.g.*, 1.0, 0.5, 0.25, 0.1 Cc. and incubated at their respective customary temperatures and the colonies counted. The easiest way to do this is to draw sector lines with a paraffin pencil through the petri dish, count one section, and multiply out to obtain the number of bacteria in the entire amount of water taken for examination. **Pakes' Discs** are employed in a similar manner. If the sample is known to be very polluted, it is a useful plan to dilute with sterile water ten times or more, and take an aliquot portion for inoculating the plate. To obtain accurate results it is important to add the melted gelatin or agar medium to the specimen of water, and not the water to the medium. This procedure ensures better mixing.

The plates are examined daily, and if liquefying organisms are numerous (which suggest sewage pollution) the examination has often to be concluded in a shorter time than would be necessary where such are not present; if possible a week should be devoted to growth.

Text books are in the habit of laying down hard and fast statements as to the purity of a water depending upon the number of organisms thus found,—they condemn, for example, as very suspicious, a water showing 1,000 organisms per Cc. It is obvious that the pathogenicity or otherwise of the bacteria must determine the conclusion. The high temperature (as for Agar plates) favours the development of the non-saprophytic organisms, but there are saprophytic organisms which also prefer the higher temperature for their development, and hence a truer conclusion can be arrived at as to the number present by growing at both the high and the low temperatures. As glucose media are very favourable to the growth of many of the yeast and fungi it is advisable also to prepare a plate culture using this medium. Yeast and fungi are, therefore, often not included in the count with the ordinary media owing to the non-favourable condition for their development. This fact has been demonstrated by us working with ordinary laboratory tap-water and also with the atmospheric air.

The next step is to conduct individual search for various sewage polluting organisms, *e.g.*, *B. coli communis*, *B. typhi abdominalis* *Vibrio choleræ*, *B. proteus*, *Klein's B. enteritidis sporogenes*, *Streptococcus*.

The search for *B. coli communis* is very important.

**B. Coli Communis.—MacConkey's method** is simplest. Fill ordinary test tubes into which Durham's tubes are introduced, with the following special broth (bile salt broth)—Sodium Taurocholate 0.5. Glucose 0.5, Peptone 2 Gm. Water 100 Cc., with 10 Cc. of 18% Sterile Litmus Solution. Add to several tubes of the broth varying amounts of the water from 0.1 up to 1.0 Cc. Incubate at 37° C. If *B. coli communis* be present there is gas production and acid production.

*B. coli* colonies are generally red on MacConkey's neutral red bile, salt agar plates. A suspected colony is carefully marked off and is tested on (*a*) neutral red agar, (*b*) peptone water, (*c*) Lactose Litmus peptone water, (*d*) Litmus milk.

The word **Flaginac** is made up to show the reactions on these media and is applied to organisms, *e.g.*, this organism which will respond to all:—

fl : fluorescence in neutral red.
ag : acid and gas in Lactose Litmus.
in : indol in peptone water.
ac : acid and clot in Litmus milk (Flaginac).

**Neutral Red** (*Syn.* Toluylene Red) is chemically Dimethyldiamidotoluphenazine hydrochloride.

Gaertner deals with the difficulties of examining water for this organism. A thorough investigation of the source and history of a water under examination is necessary,—this is more important than laboratory diagnosis. To ascertain the *origin* of the organism if found,—whether from sewage or other human source, cattle, cultivated lands, etc.—B.M.J. i/11,1334.

**In searching for B. typhosus**, which is a very difficult matter, and almost invariably attended with negative result, the enrichment method of Hoffman and Ficker is recommended side by side with some method of chemical precipitation.

Scheme of work to be done :—

- 1. ISOLATION.
  - 1. Filtration under pressure (not recommended).
  - 2. Chemical precipitation
    - Schüder's process.
    - Ficker's ,,
    - Alum ,,
  - 3. Serum agglutination.
  - 4. Enrichment process, using water itself as medium.
  - 5. Cambier's process.
  - 6. Solid Media
    - Gelatin (Elsner's, &c.)
    - Bile Salt Agar.
    - Glucose and Lactose Agars.
    - Drigalski-Conradi Medium, Crystal Violet.
    - Endo's medium.
- 2. IDENTIFICATION.
  - Morphological and cultural characters, &c.
  - Specific Reactions : Pfeiffer's Agglutination. Test.

**Schuder's precipitation method** consists in adding to 2 litres of the water, 20 Cc. of 7.75% Solution of Sodium Hyposulphite, and 20 Cc. of 10% Lead Nitrate Solution. Plates are made from the precipitate containing the bacilli.

**Ficker's precipitation method.**—Render 2 litres faintly alkaline with Soda and add 7 Cc. of 10% Ferrous Sulphate Solution The precipitate is dissolved in 25% neutral Potassium Tartrate, and plates are prepared.

**Alum method.**—Similar to the above by treating the sample with Aluminium Potassium Sulphate.

**Serum Agglutination.**—Add 1 Cc. of the sample to each of a number of broth tubes, and incubate at 37° C. three or four days. To those with sediment add a few drops of active anti-typhoid serum. Clumps are centrifugalised, and the clear liquid drawn off. Emulsify deposit and prepare plates.

**Enrichment process.**—To the sample add Nutrose 1%, Caffeine 0.5%, Crystal Violet 0.001% Incubate 12 hours at 37° C. Isolate typhoid bacilli on plates,—the colon bacilli will have been almost entirely restrained in their growth ; the method is, however, not wholly reliable.

**Cambier's process.**—By filtration of an incubated inoculated alkaline peptone solution.

**Of Solid Media.**—Drigalski's is best. It consists of a nutrose-lactose-litmus agar with a trace (0.001%) of crystal violet. After incubation typhoid colonies are bluish white.

**Endo's Medium.**—An alkaline lactose agar containing fuchsin rendered colourless by sodium sulphite. Typhoid colonies colourless,—*B. coli* colonies are sufficiently acid to produce a bright red colour.—Jl. Hygiene, Oct., 1905, Vol. 5. No. 4.

**Rapid method which may be utilised in search for B. typhosus.**—"Concentrate " at least two litres of the water by filtration through a Chamberland filter. Brush off the organisms from surface of candle into sterile vessel containing about 10 Cc. of sterile water. Brush plates with the emulsion and cultivate in the ordinary manner on gelatin and agar, or on a medium with the addition of phenol (Parietti's for instance). After incubation suspicious colonies are picked out and cultivated on various media, concluding with the serum diagnosis method of Pfeiffer.

### London Water.

Simple storage of raw river water for a short time will cause an enormous reduction in the number of Typhoid organisms if present, *e.g.*, water infected with 8,000,000 bacilli per Cc. after 1 week showed only 400 bacilli, *i.e.*, 99.995% reduction.—Houston, Report on Research Work Metropolitan Water Board —L. ii./08,255.

Results of examinations of 5,451 colonies from 24 samples of raw Thames and Lee waters showed one colony resembling *Gaertner's* Bacillus and another like B. Typhosus. On the results of search of the raw river waters for *fæcal Streptococci* it is concluded that 10,000 gallons contain less than 1 lb. of human fæces. The chances of any number of these Streptococci ever reaching the consumer of stored and filtered water are extremely minute. '*Morgan's No.* 1 *Bacillus* (regarded as being the cause of infective enteritis of infantile diarrhœa), was not found in the raw waters.

With regard to *Chlera Vibrios* added to the raw Thames, Lee and New River waters, experiments show that 99.9% perished in a week. Fourth and Fifth Reports to Metropolitan Water Board by A. C. Houston, B.M.J ii./10, 471 : L. ii./10,753.

Even a week's storage of raw river water is an enormous protection against Typhoid Bacilli and less than a month's storage is apparently absolute protection against typhoid fever. Sixth Report to Met. Water Board by A. C. Houston.—B.M.J. i./11,261

**Vibrio Cholerae.**—To detect : inoculate peptone water, preferably in an Erlenmeyer flask with 100 Cc. of the water. Incubate and test for indol product and search for typical comma-shaped organisms, which are actively motile and decolourised by Gram's method. Test further with usual laboratory media, and also conduct serum agglutination test.

Results with six vibrios.—B.M.J. i./07,735.

**B. proteus.**—The ordinary laboratory media and methods may be employed for the various types of *Proteus*.

**Klein's Bacillus Enteritidis Sporogenes.**—Add to a fresh milk tube 1 Cc. of the water or a small quantity of the 'concentrated' water. Heat to 80° C. for 20 minutes to kill off other organisms, excepting spores of the organism searched for (Kitasato's method); grow in Buchner's tube, *i.e.*, in an atmosphere of nitrogen for 24 to 36 hours. If result be separation of milk, stringy curd, and excessive whey, test for pathogenicity on guinea-pig. The animal succumbs within 36 to 48 hours (if very virulent in 24). Post-mortem signs : bloody œdema at seat of inoculation, offensive odour, hair of animal easily detached. Films stained by Gram's method from œdema fluid show typical non-sporing organisms. To further test, a blood serum tube is inoculated from the œdema fluid and incubated under anæobic conditions. The medium is eventually liquefied by the organism and films prepared from this show the typical sporing organism of Klein.

**Streptococcus.**—Glycerin Agar is a good medium for, but this medium is not quite so favourable for some of the other cocci. Agar plates may be brushed or prepared in the ordinary way, incubated at blood heat, and all discrete colonies examined by films or ordinary sub-cultures made on various laboratory media.

***Conclusions.***—The presence of any of the above organisms would indicate sewage contamination.

If *B. Coli communis* be accompanied by the *Streptococcus* this would be considered dangerous (Horrocks).

NOTE.—A bacteriological examination according to provisions of Royal Institue of Public Health, 1903-1904, should include :—

(*a*). Enumeration of the bacteria present on a medium incubated at room temperature (18 to 22° C.)

(*g*.) Search for *B. coli* and identification and enumeration of the organism if present.

(*c*.) Enumeration of the bacteria present on a medium incubated at blood heat (36.38° C.).

(*d*.) Search and enumeration of *Streptococci*. May also be advisable to search for *B. enteritidis sporogenes*.

**Swimming Bath Water.**—(According to Miguel's standard pure water may contain 100 to 1,000 organisms per Cc., very impure being defined as containing 100,000 and upwards)). It was found that the water in question on entering the bath contained 43 organisms per Cc. Coli-form or intestinal organisms were present in 5 Cc. but not in 1 Cc.. Water from the 1st class bath after 194 people had been in it gave 2,850 organisms per Cc. Coli-form organisms present in 5 Cc. The 2nd class bath after 767 persons had been in it gave about 15,000 organisms per Cc. Coli-form or intestinal organisms in 0.5 Cc. water, but not in 0.1 Cc. On another occasion twenty times the quantity of organisms were found in the 2nd class bath. Further examinations showed that the average number of organisms in two samples of 1st class was 110,000 per Cc. and the average in three samples of 2nd class was 126,000 per Cc. Though many more individuals had used the

2nd class bath the water was not so very much worse than the 1st class,—the organisms in both cases were both pathogenic and non-pathogenic. Recommendation to empty the baths more often.—L. ii./10,542,578.

# INTERNATIONAL, 1912, AND B.P. ATOMIC WEIGHTS.

In working out the Molecular Weights of Compounds, we have, except when otherwise stated, first indicated same in terms of the B.P. Values in the case of bodies containing elements mentioned in the table on p. 435 of that work; then follow in the text in brackets the weights calculated with the International Weights, 1912, marked "I. Wts." All other bodies containing elements not in the B.P. are calculated in terms of the 1912 (0=16) International Equivalents.

| | | I. Wts. 1912. O=16. | B.P. 1898. (H=1) |
|---|---|---|---|
| Aluminium | Al | 27·1 | 26·90 |
| Antimony | Sb | 120·2 | 119·00 |
| Argon | A | 39·88 | — |
| Arsenic | As | 74.96 | 74·5 |
| Barium | Ba | 137·37 | 136·4 |
| Bismuth | Bi | 208·0 | 207·3 |
| Boron | B | 11 | 10·85 |
| Bromine | Br | 79·92 | 79·35 |
| Cadmium | Cd | 112·4 | — |
| Cæsium | Cs | 132·81 | — |
| Calcium | Ca | 40·07 | 39·71 |
| Carbon | C | 12·00 | 11·91 |
| Cerium | Ce | 140·25 | 139·2 |
| Chlorine | Cl | 35·46 | 35·19 |
| Chromium | Cr | 52·0 | 51·74 |
| Cobalt | Co | 58·97 | — |
| Columbium | Cb | 93·5 | — |
| Copper | Cu | 63·57 | 63·12 |
| Dysprosium | Dy | 162·5 | — |
| Erbium | E | 167·7 | — |
| Europium | Eu | 152·0 | — |
| Fluorine | F | 19 | — |
| Gadolinium | Gd | 157·3 | — |
| Gallium | Ga | 69·9 | — |
| Germanium | Ge | 72·5 | — |
| Glucinum | Gl | 9·1 | — |
| Gold | Au | 197·2 | 195·70 |
| Helium | He | 3·99 | — |
| Hydrogen | H | 1·008 | 1·00 |
| Indium | In | 114·8 | — |
| Iodine | I | 126·92 | 125·90 |
| Iridium | Ir | 193·1 | — |
| Iron | Fe | 55·84 | 55·60 |
| Krypton | Kr | 82·92 | — |
| Lanthanum | La | 139·0 | — |
| Lead | Pb | 207·1 | 205·35 |
| Lithium | Li | 6·94 | 6·97 |
| Lutecium | Lu | 174 | — |
| Magnesium | Mg | 24·32 | 24·18 |
| Manganese | Mn | 54·93 | 54·52 |
| Mercury | Hg | 200·6 | 198·80 |
| Molybdenum | Mo | 96·0 | — |
| Neodymium | Nd | 144·3 | — |
| Neon | Ne | 20·2 | — |
| Nickel | Ni | 58·68 | — |
| Niton | Nt | 222·4 | — |
| Nitrogen | N | 14·01 | 13·94 |
| Osmium | Os | 190·9 | — |
| Oxygen | O | 16·00 | 15·88 |
| Palladium | Pd | 106·7 | — |
| Phosphorus | P | 31·04 | 30·80 |
| Platinum | Pt | 195·2 | 193·30 |
| Potassium | K | 39·1 | 38·83 |
| Praseodymium | Pr | 140·6 | — |
| Radium | Ra | 226·4 | — |
| Rhodium | Rh | 102·9 | — |
| Rubidium | Rb | 85·45 | — |
| Ruthenium | Ru | 101·7 | — |
| Samarium | Sm | 150·4 | — |
| Scandium | Sc | 44·1 | — |
| Selenium | Se | 79·2 | — |
| Silicon | Si | 28·3 | — |
| Silver | Ag | 107·88 | 107·11 |
| Sodium | Na | 23 | 22·88 |
| Strontium | Sr | 87·63 | — |
| Sulphur | S | 32·07 | 31·83 |
| Tantalum | Ta | 181·5 | — |
| Tellurium | Te | 127·5 | — |
| Terbium | Tb | 159·2 | — |
| Thallium | Tl | 204 | — |
| Thorium | Th | 232·4 | — |
| Thulium | Tm | 168·5 | — |
| Tin | Sn | 119·0 | 118·20 |
| Titanium | Ti | 48·1 | — |
| Tungsten | W | 184·0 | — |
| Uranium | U | 238·5 | — |
| Vanadium | V | 51 | — |
| Xenon | X | 130·2 | — |
| Ytterbium | Yb | 172·0 | — |
| Yttrium | Yt | 89·0 | — |
| Zinc | Zn | 65·37 | 64·91 |
| Zirconium | Zr | 90·6 | — |

The U.S.P. adopted International 1905 Standards throughout (H=1) with the exception of Radium, which is given as 223·0. The weights of many elements have since then been altered.

## Suggested International Atomic Weights for Pharmaceutical Purposes.

The atomic weights of elements employed in the pharmacopœias of different nations show variation in magnitude, particularly with regard to the first, second and third place of decimals. The important elements arsenic, bismuth, bromine, chlorine, iodine, lithium, silver, sodium, all show variations, and these are not accounted for by the fact that the oxygen standard is adopted by some and the hydrogen standard by others. The International Committee on Atomic Weights every year introduces corrections, necessary scientifically from time to time; for example, the Committee of 1909 introduced corrections in chlorine, sulphur, iodine, magnesium, and sodium. In 1910 arsenic and chromium were altered. In 1911 lithium, phosphorus, platinum, and strontium (*inter alia*) were altered. In 1912 calcium, iron, mercury and thorium were amongst those altered. The author suggests the following ' Rounded off ' weights which are those in the French Pharmacopœia, with the exception of a slight alteration of Platinum and the addition of Cerium, Thorium and Tin, as sufficiently accurate for general pharmaceutical work. If " rounded-off " *International* Standards for Pharmaceutical Purposes could be arranged, they would tend to general uniformity. These pharmaceutical standards should, it is suggested, be officially adopted in the pharmacopœias in different countries on their next revisions, and should remain in force for some years, or until some important discovery necessitated a complete radical change in one or more of the weights. It is obviously unsatisfactory for a pharmacopœia of any nation to adopt International Weights issued by the Committee thereon as is the custom, because these are continually fluctuating—particularly in view of the fact that a pharmacopœia is usually current as a standard work for a period of ten years or thereabouts. The pharmacist, however, in carrying out his pharmaceutical operations is able to control his products without the necessity of employing ultra-scientific figures. The author has not lost sight of the fact that analytical data would be influenced by a " rounded-off " revision. The influence on the whole would be for the general good. Again, an International Unification for pharmacy as suggested would do away with the extraordinary anomaly of seven current European pharmacopœias giving one of the most important elements four different weights, and only two of the four agreeing with the current " International Atomic Weights."

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*From a paper by W.H.M., read at an Evening Meeting of the Pharmaceutical Society of Great Britain, in London. P. J. i,/II, 170,178.

## Suggested Atomic Weights.

| | | | |
|---|---|---|---|
| Aluminium | 27 | Lithium | 7 |
| Antimony | 120 | Magnesium | 24 |
| Arsenic | 75 | Manganese | 55 |
| Barium | 137 | Mercury | 200 |
| Bismut | 208 | Nitrogen | 14 |
| Boron | 11 | Oxygen | 16 |
| Bromine | 80 | Phosphorus | 31 |
| Calcium | 40 | Platinum | 195 |
| Carbon | 12 | Potassium | 39 |
| Cerium | 140 | Silicon | 28 |
| Chlorine | 35·5 | Silver | 108 |
| Chromium | 52 | Sodium | 23 |
| Copper | 63·5 | Strontium | 87. |
| Gold | 197 | Sulphur | 32 |
| Hydrogen | 1 | Tin | 119 |
| Iodine | 127 | Zinc | 65 |
| Iron | 56 | Thorium | 232 |
| Lead | 207 | | |

A Note on Percentage errors with "Rounded-off" weights—P.J. i./12, 365.

Atomic Weights, Determinations of.—An eulogy of work in America. Of the 83 elements at present known and of which the atomic weights are given annually in the International Tables, 28 of these estimations, which are regarded as among the best ascertained values, are to be credited to the Harvard laboratory.—Nature, Aug. 18, 1910, p. 207.

## Periodic Table of Elements founded on that of Mendeléeff. (Principles of Chemistry 1905.) Revised to 1912 Atomic Weights.

| Zero Group. | Group I. | Group II. | Group III. | Group IV. | Group V. | Group VI. | Group VII | Group VIII. |
|---|---|---|---|---|---|---|---|---|
| *x* | | | | | | | | |
| *y* | H=1·008 | | | | | | | |
| He=3·99 | Li=6·94 | Gl(Be)=9·1 | B=11 | C=12 | N=14·01 | O=16 | F=19 | |
| Ne=20·2 | Na=23 | Mg=24·32 | Al=27·1 | Si=28·3 | P=31·04 | S=32·07 | Cl=35·46 | |
| A=39·88 | K=39·1 | Ca=40·07 | Sc=44·1 | Ti=48·1 | V=51 | Cr=52 | Mn=54·93 | Fe=55·84 Co=58·97 Ni=58·68 |
| | Cu=63·57 | Zn=65·37 | Ga=69·9 | Ge=72·5 | As=74·96 | Se=79·2 | Br=79.92 | |
| Kr=82·92 | Rb=85·45 | Sr=87·63 | Yt=89 | Zr=90·6 | Cb=93·5 | Mo=96 | | Ru=101·7 Rh=102·9 Pd=106.7 |
| | Ag=107·88 | Cd=112·4 | In=114·8 | Sn=119 | Sb=120·2 | Te=127·5 | I=126·92 | |
| Xe=130·2 | Cs=132·81 | Ba=137·37 | La=139 | Ce=140·25 | | | | |
| | | | Yb=172 | | Ta=181·5 | W=184 | | Os=190·9 Ir=193·1 Pt=195·2 |
| | Au=197·2 | Hg=200·6 | Tl=204 | Pb=207·1 | Bi=208 | | | |
| | | Ra=226·4 | | Th=232·4 | | U=238·5 | | |

In an Appendix to "The Principles of Chemistry 1905" Mendeléeff included the elements of the Argon group and Radium, and found places in addition for two hypothetical elements which he placed before Helium and designated *x* and *y*. *y* is supposed to be an analogue of Helium and may be identified hereafter with "Coronium" which has been recognised in the Sun's coronal atmosphere. This gas according to Mendeléeff would have density about 0·2 and therefore, molecular weight 0·4 or about $\frac{1}{10}$ that of Helium.

*x* is the 'Ether' which Mendeléeff supposes a molecular structure. It is assumed to be inert like the Argon group and to possess a low density and Atomic Weight estimated at 0·000,000,000,053.—Mendeléeff Memorial Lecture.—Tilden. "Nature" 3/2/10, p. 416.

## ACTION OF ACIDS ON THE COMMON METALS AND THEIR OXIDES.

The reaction between Acids and the Common Metals is a matter frequently arising and one concerning which information is not always available. In arranging the following table it was necessary to check many of the interactions experimentally as we found statements in the literature to vary greatly in many instances.

| SUBSTANCE. | | ACID HYDROCHLORIC. | | ACID SULPHURIC. | | ACID NITRIC. | | REMARKS. |
|---|---|---|---|---|---|---|---|---|
| | | Conic | Dilute. (Off.). | Conc. | Dilute. (Off.). | Conc. | Dilute. (Off.). | |
| ***Aluminium.** | Hot. | Soluble. Forms AlCl. | Easily Soluble.—forms $AlCl_3$. | Soluble. Forms $Al_2(SO_4)_3$ | Slowly attacked. | Soluble. Forms $Al(NO_3)_3$ and Oxides of Nitrogen. | Slowly soluble. | Attacked by NaOH or KOH Solutions. Soluble in cold Acetic Acid. quicker in hot. |
| | Cold. | Ditto. | Ditto. | Slightly attacked. | Unattacked | Scarcely attacked. | No action. | |
| **Aluminium Oxide.** (Amorphous) $Al_2O_3$. | Hot. | Slightly Soluble. (Forms $AlCl_3$). | Slowly soluble. (Forms $AlCl_3$). | Slightly soluble. | Soluble. Forms $Al_2(SO_4)_3$ | Slowly soluble. Forms Al $(NO_3)_3$. | Slowly soluble. Forms Al $(NO_3)_3$. | *Ignited* (Amorphous) Oxide is unattacked by Acids, except hot $H_2SO_4$. |
| | Cold. | Almost insoluble. | Ditto. | Ditto. | Ditto. | Ditto. | Ditto. | |
| **Antimony** | Hot. | Pure Antimony is insoluble. | Slightly soluble. | Soluble. Forms $Sb_3(SO._4)_3$ and $SO_2$ | Insoluble. | Oxidised but not dissolved. | Oxidised but not dissolved. | Aqua Regia dissolves forming Antimonous or Antimonic Chloride according to duration of action |
| | Cold. | No action. | No action. | No action. | Insoluble. | Practically no action. | No action. | |
| **Antimonic Oxide.** $Sb_2O_5$. | Hot. | (Forms $SbCl_5$). | Slightly soluble. | Soluble, | Slightly soluble. | Practically insoluble. | Very slightly soluble. | Soluble in KOH and NaOH Solutions Insoluble in $NH_4OH$. |
| | Cold | Slowly soluble to form $SbCl_3$. | No action. | Slightly soluble. | Very slightly soluble. | Ditto. | Ditto | |

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* See under Chromium.

| SUBSTANCE. | | ACID HYDROCHLORIC. Conc. | ACID HYDROCHLORIC. Dilute. (*Off.*). | ACID SULPHURIC. Conc. | ACID SULPHURIC. Dilute. (*Off.*). | ACID NITRIC. Conc. | ACID NITRIC. Dilute. (*Off.*). | REMARKS. |
|---|---|---|---|---|---|---|---|---|
| **Antimonous Oxide** $Sb_2O_3$ | Hot. | Soluble. Forms $SbCl_3$ | Soluble. Forms SbOCl more or less according to proportion of Acid. | Soluble. | Very slightly soluble. | Forms $Sb_2O_5$ and $Sb_4O_6$ | Slightly soluble | Soluble in Acetic, Tartaric and Benzoic Acids, also in Glycerin, Sodium Hydrate and Potassium Hydrate Solutions.<br>Easily soluble in Aqua Regia forming $SbCl_3$ or $SbCl_5$ according to length of action. |
| | Cold. | Slowly soluble. | Slightly soluble. | Slightly soluble. | Ditto. | Slightly soluble. | Ditto. | |
| **Arsenium** | Hot. | Slowly soluble. Forms $AsCl_3$. | No action. | Soluble. Forms $As_2O_3$ and $SO_2$. | Practically no action. | Soluble. Forms $H_3AsO_4$. | Soluble. Forms $H_3AsO_4$ | Soluble in Sodium Hypochlorite Solution. |
| | Cold. | Practically no action. | Ditto. | No action. | No action. | Ditto. | Practically no action. | |
| **Arsenic Oxide** $As_2O_5$ | Hot. | Soluble. Forms $AsCl_3$ and Chlorine on prolonged boiling. | Soluble. | Soluble. | Soluble. | Soluble | Soluble. | Very soluble in water |
| | Cold | Soluble without change. | Soluble. | Ditto. | Ditto | Ditto. | Ditto. | |
| **Arsenious Oxide** $As_2O_3$ | Hot. | Soluble. Forms $AsCl_3$. | Soluble. Forms more or less AsOCl according to proportions of Acid. | Soluble. | Slightly soluble. | Soluble. Forms $H_3AsO_4$. | Soluble. Forms $H_3AsO_4$. | Soluble in Alkalies. |
| | Cold. | Ditto. | Slightly soluble. | Slowly soluble. | Ditto | Ditto. | Slightly soluble, without changing- | |

| SUBSTANCE. | | ACID HYDROCHLORIC. | | ACID SULPHURIC. | | ACID NITRIC. | | REMARKS. |
|---|---|---|---|---|---|---|---|---|
| | | Conc. | Dilute. (*Off.*). | Conc. | Dilute. (*Off.*). | Conc. | Dilute. (*Off.*). | |
| **Bismuth** | Hot. | Scarcely acted on. | No action. | A slightly soluble basic Sulphate formed and $SO_2$. | No action. | Soluble. Forms $Bi(NO_3)_3$ and oxides of Nitrogen. | Soluble. Forms $Bi NO_3$ or $Bi ONO_3$ according to quantity of acid. | Aqua Regia converts into $Bi Cl_3$. |
| | Cold. | Insoluble. | Ditto. | Scarcely acted on. Schmidt says forms $Bi_2(SO_4)_3$. | Ditto. | Ditto. | Scarcely acted on. | |
| Bismuth Oxide $Bi_2O_3$ | Hot. | Soluble. Forms $BiCl_3$. | Soluble. | Slightly soluble. Forms $Bi_2(SO_4)_3$. | Slightly soluble. Forms Sulphate. | Soluble. Forms $Bi(NO_3)_3$. | Soluble. Forms Nitrate. | Soluble in strong hot NaOH Solution. |
| | Cold. | Ditto. | Ditto. | Very slightly soluble. | Very slightly soluble. | Ditto. | Ditto. | |
| ***Chromium** (Reduced from $CrCl_3$ by Zn.). | Hot. | Soluble. Forms $CrCl_2$ quickly oxidizing to $CrCl_3$. | Soluble. | Easily soluble. | Easily soluble. Forms $CrSO_4$ quickly oxidizing to $Cr_2(SO_4)_3$. | Practically no action. | Insoluble. | 'β' Chromium reduced from $CrCl_3$ by ignition with Carbon is said to be unattacked by Aq. Regia or any Acids. |
| | Cold. | Ditto. | No statement. | Insoluble. | No statement. | Insoluble. | Insoluble. | |
| Chromic Oxide $Cr_2O_3$ (Green Amorphous | Hot. | Soluble. Forms $CrCl_3$ | Soluble. Forms $CrCl_3$ | Forms $Cr_2(SO_4)_3$. | Soluble. Forms $Cr_2(SO_4)_3$. | Soluble. Forms $Cr(NO_3)_3$ (?). | Soluble. Forms $Cr(NO_3)_3$ (?). | Crystalline $Cr_2O_3$ is insoluble in all Acids |
| | Cold. | Ditto. | Ditto. | Ditto. | Ditto. | Ditto. | Ditto. | |

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*NOTE.—By dissolving strongly heated Chromic Oxide in hot concentrated $HNO_3$ (1.4) a solution is obtained from which $Cr_2(NO_3)_6,15H_2O$ crystallises on cooling. In dry air this loses $6H_2O$ with formation of $Cr_2(NO_3)_6,9H_2O$. Similarly $Al_2(NO_3)_6.15H_2O$ is produced stable in ordinary air.—Milorad Z. Jovitschitsch Monatsh, 1912, 33,9-18 per J C.S.A. ii./12,261.

| SUBSTANCE. | | ACID HYDROCHLORIC. | | ACID SULPHURIC. | | ACID NITRIC. | | REMARKS. |
|---|---|---|---|---|---|---|---|---|
| | | Conc. | Dilute. (*Off.*). | Conc. | Dilute. (*Off.*). | Conc. | Dilute. (*Off.*). | |
| **Chromic Oxide** $CrO_3$ (Red). | Hot. | Soluble. Forms $CrCl_3$ and Chlorine. | Soluble without decomposition unless the solution be very concentrated. | Soluble. Forms $Cr_2(SO_4)_3$ and Oxygen. | Soluble without decomposition. | Soluble without decomposition. | Soluble without decomposition. | Very soluble in water to form $H_2CrO_4$. |
| | Cold. | Ditto. | Soluble without decomposition. | Ditto. | Ditto. | Ditto. | Ditto | |
| **Cobalt** | Hot. | Soluble. Forms $CoCl_2$ | Soluble. Forms $CoCl_2$ | Attacked. Forms $Co(SO_4)$ and $SO_2$. | Soluble. Forms $Co(SO_4)$. | Soluble. Forms $Co(NO_3)_2$ and Nitrogen Oxides. | Soluble Forms $Co(NO_3)_2$ and Oxides of Nitrogen | |
| | Cold. | Ditto. | Ditto. | Unattacked. | Ditto. | Ditto. | Ditto. | |
| **Cobalt (ous) Oxide** | Hot. | Soluble. Forms $CoCl_2$. | Soluble. Forms $CoCl_2$. | Soluble. Forms $Co(SO_4)$. | Soluble. Forms $CoSO_4$. | Soluble. Forms $Co(NO_3)_2$. | Soluble. Forms $Co(NO_3)_2$. | |
| | Cold. | Ditto. | Ditto. | Ditto. | Ditto. | Ditto. | Ditto. | |
| **Copper** | Hot. | Very slowly soluble. Forms $Cu_2Cl_2$ (in contact with the air). | Very slightly soluble. | Slowly soluble. Forms $CuSO_4$, $CuS$ and $SO_2$. | Not attacked. | Soluble. Forms $Cu(NO_3)_2$ and Oxides of Nitrogen. | Soluble. Forms $Cu(NO_3)_2$ and Oxides of Nitrogen. | Slowly soluble in Concentrated Solutions of Caustic Alkalies. |
| | Cold. | Not attacked. | Not attacked. | Not attacked. | Not attacked. | Ditto. | Scarcely attacked. | |

| SUBSTANCE. | | ACID HYDROCHLORIC. | | ACID SULPHURIC. | | ACID NITRIC. | | REMARKS. |
|---|---|---|---|---|---|---|---|---|
| | | Conc. | Dilute. (*Off.*). | Conc. | Dilute. (*Off.*). | Conc. | Dilute. (*Off.*). | |
| **Copper (-ic) Oxide** (Black) CuO | Hot. | Soluble. Forms $CuCl_2$. | Soluble. Forms $CuCl_2$. | Soluble. Forms $CuSO_4$. | Soluble. Forms $CuSO_4$. | Soluble. Forms $Cu(NO_3)_2$. | Soluble. Forms $Cu(NO_2)_2$. | Slowly soluble in hot concentrated caustic alkali Solutions. |
| | Cold. | Ditto. | Ditto. | Slightly soluble. | Ditto. | Ditto. | Ditto. | |
| **Copper (ous) Oxide** (Red) $Cu_2O$. | Hot. | Soluble. Forms $Cu_2Cl_2$. | Forms $Cu_2Cl_2$. | Soluble. Forms $CuSO_4$ and $SO_2$. | Forms $CuSO_4$ and Copper. | Soluble. Forms $Cu(NO_3)_2$ and Oxides of Nitrogen. | Soluble. Forms $Cu(NO_3)_2$ and Oxides of Nitrogen. | Same as Black Oxide. |
| | Cold. | Forms $CuCl_2$ and Copper. | Forms $CuCl_2$ and Copper. | Forms $CuSO_4$ and Copper. | Ditto. | Ditto. | Slightly soluble. | |
| **Gold** | Hot. | Not attacked. | Not attacked. | Not attacked. | Not attacked. | Not attacked. | Not attacked. | Soluble in Aqua Regia to form $AuCl_3$ |
| | Cold. | Ditto. | Ditto. | Ditto. | Ditto. | Ditto. | Ditto. | |
| **Gold (ic) Oxide.** $Au_2O_3$. | Hot. | Slightly soluble. | Slightly soluble. | Slightly soluble. | Slightly soluble. | Soluble. | Slightly soluble. | Soluble in Conc. **KOH** Solution and **KCN** Solution. |
| | Cold. | Ditto. | Ditto. | Ditto. | Ditto. | Ditto. | Ditto. | |
| **Iron.** | Hot. | Soluble. Forms $FeCl_2$. | Soluble. Forms $FeCl_2$. | Soluble. Forms $FeSO_4$ and $SO_2$. | Soluble. Forms $FeSO_4$. | Soluble. Forms $Fe(NO_3)_3$ and Oxides of Nitrogen. | Soluble. Forms $Fe(NO_3)_3$ and Oxides of Nitrogen. | |
| | Cold. | Ditto. | Ditto. | No action. | Ditto. | Rendered passive. | Ditto. | |

| SUBSTANCE. | | ACID HYDROCHLORIC. Conc. | ACID HYDROCHLORIC. Dilute. (*Off.*). | ACID SULPHURIC. Conc. | ACID SULPHURIC. Dilute. (*Off.*). | ACID NITRIC. Conc. | ACID NITRIC. Dilute. (*Off.*). | REMARKS. |
|---|---|---|---|---|---|---|---|---|
| Iron (-ic) Oxide. $Fe_2O_3$. | Hot. | Soluble. Forms $Fe_2Cl_6$. | Soluble. Forms $Fe_2Cl_6$. | Forms $Fe_2(SO_4)_3$ which dissolves on dilution. | Very slight action. | Very slight action. | Practically no action. | Strongly ignited Oxide practically insoluble in all acids. |
| | Cold. | Action slight. | Action practically nil. | Action slight. | Practically no action. | Practically no action. | Ditto. | |
| **Lead.** | Hot. | Action slight. Forms $PbCl_2$. | Action very slight. | Action vigorous. Forms $PbSO_4$. | Action very slight. | Action slow. Forms $Pb(NO_3)_2$ & oxides of Nitrogen. | Action vigorous. Forms $Pb(NO_3)_2$& oxides of Nitrogen. | Action greatly depends on the condition of the lead—whether sheet or finely divided, etc. |
| | Cold. | Action very slight. | Ditto. | Action very slight. | Ditto. | Action slight. | Action slight. | |
| Lead Oxide (Litharge) PbO. | Hot. | Soluble. Forms $PbCl_2$. | Soluble. Forms $PbCl._2$. | Forms $PbSO_4$. | Forms $PbSO_4$. | Readily soluble. Forms $Pb(NO_3)_2$. | Easily soluble. Forms $Pb(NO_3)_2$. | Soluble in conc. KOH and NaOH solutions. Easily in Acetic Acid. |
| | Cold. | Ditto. | Ditto. | Ditto. | Ditto. | Ditto. | Ditto. | |
| **Magnesium** | Hot. | Easily soluble. Forms $MgCl_2$. | Easily sol- Formuble. $MgCl_2$. | Soluble. Forms $MgSO_4$ $MgH_2(SO_4)_2$ and $SO_2$. | Soluble. Forms | Soluble. Forms, $Mg(NO_3)_2$ Oxides of Nitrogen, Hydrogen and Ammon. Nitrate. | Soluble. Forms $Mg(NO_3)_2$ Hydrogen & Oxides of Nitrogen. | Soluble in Ammonium Chloride Solution. |
| | Cold. | Ditto. | Ditto. | Action very slight. | Ditto. | Ditto. | Ditto. | |

| SUBSTANCE. | | ACID HYDROCHLORIC. Conc. | ACID HYDROCHLORIC. Dilute. (*Off.*). | ACID SULPHURIC. Conc. | ACID SULPHURIC. Dilute. (*Off.*). | ACID NITRIC. Conc. | ACID NITRIC. Dilute. (*Off.*). | REMARKS. |
|---|---|---|---|---|---|---|---|---|
| **Magnesium Oxide.** $MgO$. | Hot. | Readily soluble. Forms $MgCl_2$. | Readily soluble. Forms $MgCl_2$. | Readily soluble. Forms $Mg\,SO_4$ & $MgH_2(SO_4)_2$. | Readily soluble. Forms $MgSO_4$. | Readily Soluble. Forms $Mg(NO_3)_2$. | Readily soluble. Forms $Mg(NO_3)_2$. | Soluble in Ammonium Salts, also in Organic Acids. |
| | Cold. | Ditto. | Ditto. | Ditto. | Ditto. | Ditto. | Ditto. | |
| **Manganese** | Hot. | Easily soluble. Forms $MnCl_2$. | Easily soluble. Forms $MnCl_2$. | Soluble. Forms $Mn\,SO_4$ and $SO_2$. | Easily soluble. Forms $Mn\,SO_4$ | Easily soluble. Forms $Mn(NO_3)_2$ & Oxides of Nitrogen. | Easily soluble. Forms $Mn(NO_3)_2$ & Oxides of Nitrogen. | |
| | Cold. | Ditto. | | Action slight. | Ditto. | Ditto. | Ditto. | |
| **Manganese Dioxide** $MnO_2$. | Hot. | Soluble. Forms $MnCl_2$ and Chlorine. | Soluble. Forms $MnCl_2$ and Chlorine. | Action slight. Forms $MnSO_4$ and Oxygen at 200° C. [or $Mn_2(SO_4)_3$ at 100° C.] —Schmidt. | Action very slight. Forms $Mn\,SO_4$ & Oxygen. | Action very slight. | Action very slight. | $MnO_2$ is more soluble in diluted Sulphuric Acid in presence of easily oxidisable bodies ($FeSO_4$, Sugar etc). with formation of $MnSO_4$ and O., the O then oxidises the substances in question. |
| | Cold. | Ditto. | Action slight. | Practically no action. | No action. | No action. | No action. | |

| SUBSTANCE. | | ACID HYDROCHLORIC. | | ACID SULPHURIC. | | ACID NITRIC. | | REMARKS. |
|---|---|---|---|---|---|---|---|---|
| | | Conc. | Dilute. (*Off.*). | Conc. | Dilute. (*Off.*). | Conc. | Dilute. (*Off.*). | |
| **Mercury** | Hot. | No action. | No action. | Forms HgSO & $SO_2$ (or Hg $SO_4$ according to proportions and temperature.) | Practically no action. | Soluble. Forms $Hg(NO_3)_2$ & Oxides of Nitrogen. | Soluble. Forms $Hg(NO_3)_2$ & Oxides of Nitrogen. | |
| | Cold. | Ditto. | Ditto. | No action. | Ditto. | Soluble. Forms $Hg(NO_3)_2$ & some $Hg_2(NO_3)_2$ and Oxides of Nitrogen. | Very slightly soluble. Forms $Hg_2(NO_3)_2$ | |
| Mercury (-ic) Oxide yellow or red variety HgO | Hot. | Soluble. Forms $HgCl_2$. | Soluble. Forms $HgCl_2$. | Soluble. Forms $HgSO_4$. | Soluble. Forms $HgSO_4$. | Soluble. Forms $Hg(NO_3)_2$. | Soluble. Forms $Hg(NO_3)_2$. | Combines easily with Organic Acids when freshly precipitated. |
| | Cold. | Ditto. | Ditto. | Ditto. | Ditto. | Ditto. | Ditto. | |
| **Nickel** | Hot. | Soluble. Forms $NiCl_2$. | Very slowly soluble. Forms $NiCl_2$. | Action slight. Forms $NiSO_4$ and $SO_2$. | Very slowly soluble. Forms $NiSO_4$. | Easily soluble. Forms $Ni(NO_3)_2$ and Oxides of Nitrogen. | Easily soluble. Forms $Ni(NO_3)_2$ and Oxides of Nitrogen. | |
| | Cold. | Ditto. | Ditto. | Practically no action. | Ditto. | Rendered passive. | Ditto. | |
| Nickel (-ous) Oxide NiO. | Hot. | Soluble. Forms $NiCl_2$. | Soluble. Forms $NiCl_2$. | Forms $NiSO_4$. | Soluble. Forms $NiSO_4$. | Soluble. Forms $Ni(NO_3)_2$. | Soluble. Forms $Ni(NO_3)_2$. | Soluble in $NH_4OH$. |
| | Cold. | Ditto. | Ditto. | Ditto. | Ditto. | Ditto. | Ditto. | |

| SUBSTANCE. | | ACID HYDROCHLORIC. | | ACID SULPHURIC. | | ACID NITRIC. | | REMARKS. |
|---|---|---|---|---|---|---|---|---|
| | | Conc. | Dilute. (*Off.*). | Conc. | Dilute. (*Off.*). | Conc. | Dilute. (*Off.*). | |
| **Nickel (-ic) Oxide** $Ni_2O_3$. | Hot. | Soluble. Forms $NiCl_2$ and Oxygen. | Soluble. Forms $NiCl_2$ and Oxygen. | Forms $NiSO_4$. | Soluble. Forms $NiSO_4$ and Oxygen | Soluble. Forms $Ni(NO_3)_2$ and Oxygen. | Soluble. Forms $Ni(NO_3)_2$ and Oxygen. | Soluble in $NH_4OH$ c evolution of Nitrogen. |
| | Cold. | Ditto. | Ditto. | Ditto. | Ditto. | Ditto. | Ditto. | |
| **Platinum** | Hot. | No action. | No action. | No action. | No action | No action. | No action. | Soluble in Aqua Regi to form $PtCl_4$. |
| **Silver** | Cold. | Ditto. | Ditto. | Ditto. | Ditto. | Ditto. | Ditto. | |
| | Hot. | Practically no action. | Practically no action. | Soluble. Forms $Ag_2SO_4$ and $SO_2$. | Action very slight. | Soluble. Forms $AgNO_3$ and Oxides of Nitrogen. | Soluble. Forms $AgNO_3$ and Oxides of Nitrogen. | Finely divided Silver is more responsive than compact Silver to Hydrochloric Acid. |
| | Cold. | Ditto. | Ditto. | No action. | No action. | Ditto. | Action slight. | |
| **Silver Oxide** | Hot. | Forms AgCl. | Forms AgCl. | Soluble. Forms $Ag_2SO_4$. | Soluble. Forms $Ag_2SO_4$. | Soluble. Forms $AgNO_3$. | Soluble. Forms $AgNO_3$. | Soluble in $NOHH_4$ and KCy Solutions. |
| | Cold. | Ditto. | Ditto. | Ditto. | Slightly soluble. | Ditto. | Ditto. | |
| **Tin** | Hot. | Soluble. Forms $SnCl_2$. | Soluble. Forms $SnCl_2$. | Dissolves forming $SnSO_4$ (Stannous Sulphate) $SO_2$ and Sulphur. | Slowly soluble. Forms $SnSO_4$. | Forms $H_2SnO_3$ (Metastannic Acid) Oxides of Nitrogen and $NH_4NO_3$. | Soluble. Forms $H_3SnO_3$, $Sn(NO_3)_4$ and Oxides of Nitrogen and $NH_4NO_3$. | Soluble in hot Concentrated NaOH or KOH solution. Forms Stannates $K_2SnO_3$ or $Na_2SnO_3$ |
| | Cold. | Soluble. Forms $SnCl_2$. | Practically no action. | Action slight. | Practically no action. | Ditto. | Soluble. Forms $Sn(NO_3)_2$. $NH_4NO_3$ and very little gas. | Aqua Regia in excess dissolves to form Stannic Chloride $SnCl_4$ |

| SUBSTANCE. | | ACID HYDROCHLORIC. | | ACID SULPHURIC. | | ACID NITRIC. | | REMARKS. |
|---|---|---|---|---|---|---|---|---|
| | | Conc. | Dilute. (*Off.*). | Conc. | Dilute. (*Off.*). | Conc. | Dilute. (*Off.*). | |
| **Tin (-ic) Oxide $SnO_2$.** | Hot. | No action. | No action. | Slightly soluble. | No action. | No action. | No action. | Slightly soluble in hot conc. NaOH or KOH solutions |
| | Cold. | Ditto. | Ditto. | No action. | Ditto. | Ditto. | Ditto. | |
| **Tin (-ous) Oxide** | Hot. | Soluble. Forms $SnCl_2$. | Soluble. Forms $SnCl_2$. | Forms Sn $O_4$. | Soluble. Forms $SnSO_4$. | Forms $SnO_2$ and Oxides of Nitrogen. | Forms $SnO_2$ and Oxides of Nitrogen. | Newth says solution in NaOH is known as Sodium Stannite |
| | Cold. | Ditto. | Ditto. | Ditto. | Ditto. | Ditto. | Soluble. Forms $Sn(NO_3)_2$. | |
| **Zinc** | Hot. | Soluble. Forms $ZnCl_2$ | Soluble. Forms $ZnCl_2$ | Forms $ZnSO_4$ & $SO_2$. | Soluble. Forms Zn $SO_4$ and H. and if not sufficiently diluted $H_2S$. | Soluble. Forms Zn $(NO_3)_2$ Oxides of Nitrogen and $NH_4NO_3$. | Soluble. Forms Zn $(NO_3)_2$ Oxides of Nitrogen and $NH_4NO_3$. | Soluble in hot Concentrated KOH and NaOH Solutions. |
| | Cold. | Ditto. | Ditto. | Forms $ZnSO_4$. | Soluble. Forms Zn $SO_4$ and H. | Soluble. | Soluble. | |
| **Zinc Oxide** | Hot. | Soluble. Forms $ZnCl_2$. | Ditto. | Slightly soluble. Forms $ZnSO_4$. | Soluble. Forms $ZnSO_4$. | Soluble. Forms $Zn(NO_3)_2$. | Soluble. Forms $Zn(NO_3)_2$. | Soluble in $NH_4Cl$ NaOH and KOH Solutions |
| | Cold. | Ditto. | Ditto. | Ditto. | Ditto. | Ditto. | Ditto. | |

# CHART FOR THE RECOGNITION OF ORGANIC CHEMICAL BODIES USED IN THERAPEUTICS.

The following chart is intended to assist in the recognition of a number of organic chemicals, both natural and synthetic, used therapeutically. It frequently happens that the Analyst is called upon to identify such substances, and without some aid to guide him the search is sometimes extremely difficult. In working with the chart the tests should be taken in rotation commencing with the action of Heat, afterwards with Heat with Sodium Hydrate, and so on from left to right. It will be found that by a simple process of elimination, bodies can be identified with some degree of accuracy.

The data in the chart have practically all been obtained by personal trials in the author's laboratory. It is possible that in some instances reactions found by others may differ from results here recorded. This may be due to (*a*) difference in commercial variety (*b*) mode of conducting the test. The following notes show methods of procedure adopted :—

Heat 0·1 Gm. in a 3 by ½ inch test tube heated in a Bunsen flame.

Heat with Sodium Hydrate.—0·1 Gm. of the substance with about five times its weight of roughly crushed Sodium Hydrate, mixed in tube and heated.

Sulphuric Acid in the cold.—A portion of the substance on a white tile touched with a glass rod dipped in Sulphuric Acid (*Off.*).

Sulphuric Acid hot.—0·1 Gm. approx. of the substance placed in test tube, 1 Cc. approx. of Sulphuric Acid added and the mixture heated in Bunsen flame.

Nitric Acid.—A portion of the substance on a white tile touched with a glass rod dipped in Nitric Acid (*Off.*).

Nitrogen, Phosphorus, Sulphur and Halogens tested for in usual manner.

Sp. Gr. and Solubilities.—In the case of the important substances these are repeated from the body of the "Extra Pharmacopœia." In other cases solubilities have been approximately determined by customary methods.

Ferric Chloride.—Add a drop or two of Ferric Chloride Test Solution (*Off.*) to about 1 Cc. of 1 in 25 solution in water.

Note.—Ferric Chloride with water alone gives brownish color on boiling. In case of a substance, *e.g.*, *Acetanilide* (which does not color in the cold) giving this also we record the result as 'nil. (The word 'Nil' throughout the Chart indicates no marked characteristic reaction in a few minutes.)

For the BROMINE WATER TEST, FEHLING'S SOLUTION, MAYER'S TEST, GOLD CHLORIDE TEST, PICRIC ACID TEST, and DRAGENDORFF'S TEST, the 1 in 25 solution of the substance is also used, or, if not soluble to that extent, a saturated solution is employed.

For formulæ for preparation of Fehling's, Mayer's, and Dragendorff's Solutions, *vide* pp. **171**, **36**, **25**.

Gold Chloride Solution is used 1 in 20.

Other **Alkaloidal Reagents** are the following:—

**Erdmann's Reagent.**—Mix 6 drops of Nitric Acid (Sp. Gr. 1.25) with water 100 Cc., add 10 drops of this to 20 Cc. of Concentrated Sulphuric Acid.

**Froehde's Reagent.** — Sulpho - molybdic Acid. — Ammonium Molybdate 1 Gm. in Concentrated Sulphuric Acid 100 Cc.

**Mandelin's Reagent.**—Sulpho-Vanadic Acid.—A 1% solution of Sodium Vanadate in Concentrated Sulphuric Acid.

**Mercuric Chloride Solution.**—1 in 20. (*Off.*)

**Platinic Chloride.**—1 in 20 (*Off.*)

**Scheibler's Reagent.**—Phospho-Tungstic Acid. Dissolve Sodium Tungstate 100 and Sodium Phosphate 70 in Water 500, acidify with Nitric Acid.

**Sonnenschein's Reagent.**—Phospho-Molybdic Acid.—Consists of a solution of Sodium Phosphomolybdate in Nitric Acid, prepared by acidulating a warm solution (50 to 60°C.) of Sodium Phosphate with Nitric Acid, and adding an excess of Ammonium Molybdate Solution. The yellow precipitate is separated, washed with water, acidulated with Nitric Acid and dissolved in a hot solution of Sodium Carbonate (using as little as possible).

The solution is evaporated to dryness and ignited at low red heat till all Ammonium Salts are volatilised, the residue moistened with Nitric Acid and again ignited. The product, consisting of Phosphomolybdate of Sodium, is dissolved in ten times its weight of water, and Nitric Acid (Sp. Gr. 1·42) added until the precipitate at first produced disappears.

**Tannic Acid.**—A Solution of Tannic Acid 1 in Water 8, Alcohol 1 freshly prepared.

**Wagner's Reagent.**—Iodine in Potassium Iodide. Iodine 5, Potassium Iodide 10, Water 100.

(NOTE.—It is important in testing with this Reagent, *e.g.*, in assaying drugs to determine whether sufficiently extracted, to note that water saturated with Ether and then acidulated gives a precipitate of Iodine on adding this reagent. If a precipitate be obtained in this way confirm by adding water,—if it is due to Iodine caused by the Ether it will dissolve again.—Am. Jl. Ph., April '09,177.)

Apologies are offered for the use of FORMULÆ in place of long chemical names, *e.g.*, HCl, NaOH, etc—these save space and are quicker to read.

Following the Chart are corroborative data with references to Text Books.

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The Therapeutic properties and further details concerning the substances dealt with are given in the body of the work—consult the index.

Contractions used in the Chart :—

a. =after
ac. =acid.
alc. =alcoholic.
alk. =alkaline.
arom. =aromatic.
b. =before.
bl. =black.
br. =brown.
ch. =chars.
col. =color.
dec'm. =decomposes.
dk. =dark.
dist. =distillate.
Drag. =Dragendorff.
eff. =effervescent.
gr. =green.
inflam. =inflammable.
insol. =insoluble.
m. =melt(s).
misc. =miscible.
mod. =moderate.
neut. =neutral.
or. =orange.
pp. =precipitate.
part =partially.
quick. =quickly.
res. =residue.
rediss. =redissolves.
sl. =slightly.
s. =sine (without).
sns. =softens.
str. =strongly.
sub. =sublime or sublimate.
v. =very.
vap =vapor.
vi. =violet.
wh. =white.
yell. =yellow.

The Abbreviations of Authors' Names are in general those used in the body of the "Extra Pharmacopœia."

| No. | Substance. | Heat. | Heat c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$. | N. P. S. & Hal. | M. Pt. (°C) |
|---|---|---|---|---|---|---|---|---|
| 1 | **Acetanilide** ... | M. sub. vap. burns | Gives off Aniline. | Nil. | Ch. slowly. | Nil. | N. | 113° |
| 2 | **Acetone** ... | Evap. c. inflam. vap. | Inflam. vap. | Nil. | Ch. quick. | Sl. br. | Nil. | — |
| 3 | **Acetophenone** | Evaps., does not ch. | Br. c. inflam. vap. | Nil. | Ch. | Nil. | Nil. | 20° |
| 4 | **Acetopyrin** .. | M. Acetic then Phenolic inflam. vap. | Red col. creeps up tube. | Nil. | Ch. v. slowly | Br. v. slowly | N. | Abt 15° |
| 5 | **Acetozone** ...... | Ch. c. sub. & white res. | Br. c. sl. arom. odor. | Sl. br. | Ch. | Sl. br. | Nil. | See bdy |
| 6 | **Acid Aceto-Salicyl.** | M. c. Acetic odor, ch. vap. burns | Nil. | Nil. | Goes br. not ch. | Nil. | Nil. | 135° |
| 7 | ,, **Acetyl-Coumaric** (*see* Tylmarin) | — | — | — | — | — | — | — |
| 8 | ,, **Agaric** ... | M. c. eff. ch. br. dist. and inflam. vap. | Nil. | Nil. | Froths. ch. quick. | Nil. | Nil. | 137 |
| 9 | ,, **Cacodylic** | M. ch. Garlic vap. burns c. As. flame | Nil. | Nil | Does not ch. | Nil. | Nil. | [illegible] |
| 10 | ,, **Camphoric** | M. and sub. c. inflam. vap. | Eff. c. pleas. odor. | Nil. | Eff. inflam. gas, ch. | Nil. | Nil. | 186° |
| 11 | ,, **Carbolic** (Cryst.) | M. and evaps. c. inflam. vap. | Nil. | Nil. | Dark red-br. not ch. | Br. c. explosion. | Nil. | 39° |
| 12 | ,, **Cholalic** (Colalin) | Part. m. c. strange odor. Ch. c. alk. inflam. vap. | Br. | Br. | Dark red-br. Ch. quick. | Br. and gummy | N. | Nil. |

| No. | SP. GR. | SOL. AQ. (1 in) | SOL. ALC. (1 in) | LITMUS. | $Fe_2Cl_6$ b. & a boil. | BROM AQ. | FEHLING. b. & a. boil. | MAYER'S. | GOLD CHL. | ACID PICRIC | DRAG. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | — | 200 | 4¼ | Neut. | Nil. | Wh. pp. | Nil. | Nil. | Nil. | Nil. | Br. pp. |
| 2 | ·7966 (pure) | Misc. | Misc. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 3 | 1·03 of liq. | V. sl. | Misc. | Neut. | Nil. | Sl. pp. rediss | Nil. | Nil. | Nil. | Nil. | Br. pp. |
| 4 | — | 160 | 3½ | Ac. | Deep vi. b. & a. | Wh. pp. | Nil. | Wh. pp. | Yell. pp. | Nil. | Red pp. |
| 5 | — | Part. | Part. | Mod. ac. | Sl. buff, pp. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 6 | — | 400 | 1 in 5 | Mod. ac, | Nil b. vi. a. | No pp. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 7 | — | — | — | — | — | — | — | — | — | — | — |
| 8 | — | Insol. | V. sl. | Neut. (alc. ac.) | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 9 | — | ½ | 4 | Str. ac. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 10 | — | About 200 or more. | Abt. 1½ | Mod. ac. | Br. pp. a. | Nil. | Reduces b. | Nil. | Nil. | Nil. | Nil. |
| 11 | — | 12 | 0.16 | Neut. | Vi. col. b. br. pp. a. | Wh. pp. rediss at f'st. | Nil. | Nil. | Bl. pp comes slow. | Nil. | Nil. |
| 12 | — | Sl. | Abt. 1 | Neut | Nil b. br. pp. a. | V. sl. pp. | Nil. | Nil. | Nil. | Nil. | V. sl. red-br. |

| No. | SUBSTANCE. | HEAT. | HEAT c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | HNO | N.P.S. & Hal. | M. P. (°C) |
|---|---|---|---|---|---|---|---|---|
| 13 | Acid Cinnamic | M. wh. sub. & inflam. vap. | Darkens v. slowly; arom. inflam. vap. | Nil. | Yell. green ch. slowly. | Nil. | Nil. | 130° |
| 14 | „ Citric ... | M. clear ch. inflam. vap. | Nil. | Nil. | Eff. inflam. vap. & ch. | Nil. | Nil. | 135–154° |
| 15 | „ Coumaric | M. ch. c inflam. vap. | Yell. eff. then colorless. | Yell. | Ch. slowly. | Yell. & strong eff. | Nil. | 200° |
| 16 | „ Cresylic | vaps.. vap. burns | Separates in 2 layers up. dark & lower light. | Nil. | Ch. quick. | Violent eff. | Nil. | — |
| 17 | „ Gallic ... | Part m & ch. Orange sub. & br. vap. burns | Turns yell. | Darkens sl. | Gradually deep red and then ch. | Br. c. eff. | Nil. | Nil. |
| 18 | „ Glycerophosph | Evaps. Res. effs & ch. vap. burns | Eff. | Nil. | Ch. | Nil. | P. | — |
| 19 | „ Hippuric | M. to clear. liq. ch c inflam. & alk. vap. | Alk. vap. | Nil. | Ch. slowly. | Nil. | N. | 187° |
| 20 | „ Malic ... | M. c sub. | Froths. Vap. burns. | Nil. | Ch. vap. burns c. blue flame. | Nil. | Nil. | Abt 180° |
| 21 | „ Meconic | Ch. c. wh. sub. & vap. | Orange then colorless. | Nil. | Straw col. not ch. | Nil. | Nil. | Nil. |
| 22 | „ Nucleinic | Ch. c. odor of burnt feath'rs | Br. c. alk. vap. | Nil. | Ch. | Gelatinises. | N.P. | Nil. |
| 23 | „ Oleic ... | Distils c sl. residue ch. | Br., and separates from fused soda. | Br. | Deep red br., then ch. | Delicate vi. col. | Nil. | — |

| No. | SP. GR. | SOL AQ. (1 in —). | Sol. Alc. (1 in -). | LITMUS. | $Fe_2Cl_6$ b. & a. boil. | BR. AQ. | FEHLING'S b. & a. boil | MAYER'S. | GOLD CHL. | ACID PICRIC. | DRAG |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 13 | — | Sl. | 10½ | Faint. ac. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 14 | — | 0.6 | 1½ | Ac. | Nil b. br., pp. a. | Nil. | Nil b. & a. | Minute crystals a. a while. | Nil. | Nil. | Nil. |
| 15 | — | 600 | 12 (or less). | Sl. ac. | Nil b. | Yell. pp. | Nil b. & a. | Nil. | Nil. | Nil. | Nil. |
| 16 | 1·053 | 70 | Misc. | Neut. | Bl. vi. b. buff pp. a. | Wh. pp. | Nil. | Nil. | Bl. pp. comes slow. | Nil. | v. sl. pp. |
| 17 | — | 100 (approx.). | 5 | Ac. | Bl. to gr. bl. b., br. bl. pp. a. | Nil. | Br. b. & a. | Nil. | Dirty br. pp. | Nil. | Nil. |
| 18 | 1·125 for 25 % | Misc. | Misc. | St'ng. ac. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 19 | — | v. sl. | 30 | Med. ac. | Nil b. & a. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 20 | — | 1 | 1½ | Ac. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 21 | — | Sl | 48 | Ac. | Deep red col. b. pp. a. | Decols. first few dps of test. | Nil b. sl. reduction a. | Nil. | Nil. | Nil. | Nil. |
| 22 | — | Almost insol. | Insol. | Faint ac. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 23 | 0·898 | Insol. | 55 | Ac. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |

| No. | Substance. | Heat. | Heat c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$. | N.P.S. & Hal. | M. Pt. (°C) |
|---|---|---|---|---|---|---|---|---|
| 24 | Acid Oxalic ... | M. & sub. | Nil. | Nil. | Decomps. to $CO_2$, CO, & $H_2O$. | Nil. | Nil. | 102° |
| 25 | ,, Pyrogallic | Sub. c. decomp | Br. to greenish yell. | Yell. col. | Ch. quick. | Br. violent eff. | Nil. | 132° |
| 26 | ,, Salicylic | Sub. vap. burns | Nil. | Nil. | Sl. br. not ch. | Nil. | Nil. | 156° |
| 27 | ,, Sclerotic | Ch. alk. vap. burns | Strong Alk. vap. | Nil. | Ch. quick | Nil. | N. | Nil. |
| 28 | ,, Stearic ... | Sub. vap. burns | Nil. | Yell. | Ch. | Nil. | Nil. | 50–55 |
| 29 | ,, Succinic | M & vol | Vap. burns | Nil. | Ch. & sl. sub. | Nil. | Nil. | 182° |
| 30 | ,, Tannic | Part m. ch orange sub. & br. inflam. vap. | Dirty br. | Dirty br. | Br. then deep vi. and ch. | Br. c. eff. | Nil. | Nil. |
| 31 | ,, Tartaric | M. ch. vap. burns | Nil. | Nil. | Eff. vap. burns | Nil. | Nil. | 162-165 |
| 32 | ,, Valerianic | Evap. c. str. odors, vap. burns | Nil. | Darkens sl. | Ch. quick. | Nil. | Nil. | |
| 33 | Acidol *vide* Betaine H Cl | — | — | — | — | — | | — |
| 34 | Acoine ... | M. yell liq. ch. alk. vap. burns | Bl floats on soda & gives Isonitrilelike odor | Sl. eff. otherwise nil. | Ch. quick | Br. to bl. | N. & Cl. | 173° |
| 35 | Aconitina ... | Ch. c acrid vap. | Fruity odor at first. | Nil. | Ch. c Ac. Benzoic odor | Nil. | N. | 190 approx. |
| 36 | Adrenalin ... | Red'sh ch. alk. vap. | Br. froth Bl. alk. vap. | Yell. col. | Ch. quick. | Yell. br. c sl. eff. | N. | — |
| 37 | Æsculin ... | M. c. sl. eff. ch. yel. dist. vap. burns. | Froths, darkens sl. vap. burns. | Darkens sl. | Red br. ch. quick. | Yell. br. c. sl. eff. | Nil. | — |
| 38 | Æthyl Bromid | Evap. | Nil. | Nil. | Nil. | Nil. | Br. | — |

| NO. | SP. GR. | SOL. AQ. (1 IN—) | SOL. ALC. (1 IN-) | LITMUS | $Fe_2Cl_6$ b.& a. boil. | BR. AQ. | FEHLING'S b.& a. boil. | MAYERS'S. | GOLD CHL. | ACID PICRIC. | DRAG. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 24 | — | 9 | 8. | St'ng. ac. | Yell. b.&a. | Nil. | Nil. | Nil. | Nil. | Nil. | Sl. pp. |
| 25 | — | 2 | 1 | Neut. | Dark br. | Nil. | Br. col. b.&a. | Nil. | Reduces | Nil. | Nil. |
| 26 | — | 500 | 3 | Mod. ac. | Deep vi. | Wh. pp. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 27 | — | Prac. all prop. | Insol. | Ac. | Dirty br.pp. b & a | Br. pp. | Green col. b. & a. | Nil. | Sl. br. pp. | Nil. | Red br.pp. |
| 28 | — | Insol. | 18 | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 29 | — | 20 | 9 | St'ng ac. | Buff pp. | Nil. | Nil. | Nil. | Nil. | Nil. | Br. pp. |
| 30 | — | 1½ slowly | 1 | Ac. | Blue bl. col. b. br. bl. pp. a. | v. s'ly stringy pp. | G'nish br. gelat. pp. b. br. a. | Nil. | Grnsh bl.pp. | Nil. | Nil. |
| 31 | — | 0.8 | 2½ | Ac. | Nil b. br. pp. a. | Nil. | Nil. | Nil 1st min., cystls aft. a while | Nil. | Nil. | Nil. |
| 32 | 0·93 (aprx) | 30 | All props. | Ac. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 33 | — | — | — | — | — |  | — | — | — | — | — |
| 34 | — | About 30 | 1 | Neut, | Nil. | Dirty pp. t'ning mauve in dil. sol. | Wh. pp. b. pink liq. floats a. | Wh. pp. | Buff pp. | Yell. pp. | Red. br.pp |
| 35 | — | v. sl. | 10 | Faint alk. | Nil. | Yell. pp. | Nil. | Wh. pp. | Yell. pp. | Yell. pp. | Br. pp. |
| 36 | — | v. sl. | v. sl. | Faint alk. | Gr. cl. b.red. a. | Nil. | G. br. sl. reden. a | Nil. | vi.col. | Nil. | Nil. |
| 37 | — | sl. | sl. | Neut. | Darkens sl. b. | Dp.rd. col. to prplsh opale cence | Bluish gr. b. & deep gr. a. | Nil. | blue col. | Nil. | Nil. |
| 38 | 1·4735 | 85 Schmidt alm.ins. | Misc. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |

| No. | SUBSTANCE. | HEAT. | HEAT c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$ | N.P.S. & Hal. | M. Pt. (°C) |
|---|---|---|---|---|---|---|---|---|
| 39 | Æthyl Chlorid | Evap. | Nil. | Nil. | Nil. | Nil. | Cl. | — |
| 40 | Æthyl Iodid... | Evap. | Nil. | Nil. | Gives off I. | Sl. darkening | I. | — |
| 41 | Agurin (Theobromine Sodium Acetate). | Part m. & sl. wh. sub. ch. alk. vap. | Alk. vap. | Eff. | Yell. does not ch. | Eff. | N. | — |
| 42 | Airol ... | Iodine vapour (bl) | Nil. | Ch. | Strong Iodine (vi.) vap. | Eff. & I. vap. emitted | I. | — |
| 43 | Albargin ... | Ch. | Br. c. Alk. vap. | Nil. | Ch. | Nil. | N. | — |
| 44 | Alcohol Methylic ... | Evap. | Br. | Ch. | Ch. | Br. | Nil. | — |
| 45 | Aldehyde Abs. | Evaps. | Ch. | Instant ch. & swells up. | Ch. immediate. | Darkens sl. | Nil. | — |
| 46 | Aldol ... | Evaps. vap. burns | Br. vap. burns. | Dark br. | Ch. instantly. | Br. | Nil. | — |
| 47 | Alloxan ... | M. to dark red br. liq. ch. & gives HCN. odor. | Blue in cold & colorless on heating alk. vap. | Nil. | Yell. but does not ch. | Nil. | N. | — |
| 48 | Aloes Barb. ... | Part m. br. yell. vap. burns. br. dist. | Red to br. col. | Br. | Ch. | Red. | Nil. | — |
| 49 | " Cape ... | Part m. br. yell. vap. burns. br. dist. | Red to br. col. | Br. | Ch. | Dirty br. | Nil. | — |
| 50 | " Soc. ... | Part m. br. yell. vap. burns. br. dist. | Red to br. col. | Red br. | Ch. | Red-br. | Nil. | — |
| 51 | Aloin ... | M. & Ch. vap. burns. | Ch. | Br. | Ch. | Deep red. | Nil. | 145 |

| No. | Sp. Gr. | Sol. Aq (1 in—). | Sol. Alc. (1 in–) | Litmus. | $Fe_2Cl_6$ b. & a. boil. | Br. Aq. | Fehling's b. & a. boil. | Mayer's. | Gold Chl. | Acid Picric. | Drag. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 39 | 0·911 to 0·916 at 8° C., U.S. | Sl. | Readily | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 40 | 1·94 | 400 | Misc. | Sl. ac. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 41 | — | 2 | Sl. | Alk. | Lt. br. br. pp. b. & a. | Nil. | Nil. | Nil. | Nil. | Nil. | Yell. br. pp |
| 42 | — | v. sl. Iodide & Gallic Acid go into solution | Incompletely sol. | Sl. ac. | Bl. | Nil. | Nil. | Nil. | Yell. pp. | Nil. | Nil. |
| 43 | — | 2 | 130 | Neut. | Nil b. opal- a. | Yel. pp. | Nil b. br. gr. a. | Yel. col. no pp. | Br. yel. pp. | Sl. yel. pp. | Br. pp rediss at first. |
| 44 | 0·796 to 0·81. | Misc. | Misc. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 45 | 0·7876 | Misc. | Misc. | Mod. ac. | Nil. | Nil. | Reduct. b. | Nil. | Nil. | Nil. | Nil. |
| 46 | — | 2 | Easily. | Neut. | Nil. | Sl. opalescence. | Nil b. gr. to red, pp. a. | Nil. | Nil. | Nil. | Br. pp. |
| 47 | — | Sl. | Sl. | Ac. | Nil. | Nil. | Nil. | Nil. | Sl. blue col. | Nil. | Nil. |
| 48 | — | Part. sol. | 6 incomplete. | Faint ac. | Vi. br. | Yell. pp. | Br. gr. | Nil. | Red col. | Nil. | Br. pp. |
| 49 | — | Part, sol. | 2 | Faint ac. | Vi. br. | Yell. pp. | Br. col. | Nil. | Br. pp (Red to vi. col.—Schmidt.) | Nil. | Br. pp. |
| 50 | — | Part. sol. | 8 incomplete. | Faint ac. | Vi. br. | Yell. pp. | Br. gr. | Nil. | Nil. | Nil. | Br. pp. |
| 51 | — | 140 | 20 | Faint ac. | Vi. br. b. & a. | Yell. pp. | Br. col. b. & a. | Nil. | Red col. | Nil. | pp. |

| No. | SUBSTANCE. | HEAT. | HEAT c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$ | N.P.S. & Hal. | M. Pt. (°C) |
|---|---|---|---|---|---|---|---|---|
| 52 | Alphogen ... | First eff. ch. c cryst. sub. | White cryst. sub. & ch. | Nil. | Eff. & ch. | Eff. no col. | Nil. | 262° c. decom |
| 54 | Aluminii Aceto-Tart. | Ch vap. burns | Vap. burns. | Nil. | Ch. | Nil. | Nil. | Nil. |
| 55 | Alypin ... | M. c. eff. then ch. Alk. vap. burns | M. & floats on soda. | Eff. str. | Goes br., not ch. | Nil. | N. & Cl. | 169 |
| 56 | Amylene Chloral Sol. 1 : 1 = Dormiol | Evaps. vap. burns. | Nil. | Dark'ns sl. | Separates, vap. burns c. gr. flame | Nil. | Cl. | — |
| 57 | Amylene Hydrate | Evaps. | Nil. | Nil. | Ch. | Nil. | Nil. | — |
| 58 | Amyl Nitris ... | Evaps. sl. res. ch. | Gr. c Alk. vap. | Blue, rapidly to br. | Ch. | Dark'ns slowly | N. | — |
|  | Amyloform .. | Ch. | Ch. | Nil. | Ch. | Nil. | Nil. | — |
| 60 | Amyl Valerianas | Evaps. vap. burns. | Ether'l odor, vap. burns | Dark'ns sl. | Dark rd. br., ch. & vap. burns c. garlic odor | Nil. | Nil. |  |
| 61 | Anæsthesine .. | M. evap. vap. burns. | Froths sl. and vap. burns | Ch. v. slowly | Nil. | Nil. | N. | 89 |
| 62 | Anilin ... | Evaps. | Nil. | Forms br. solid and gets hot | Ch. slowly | Forms pink solid. | N. | — |
| 63 | Anthrarobin ... | Br. sub. wh. res. | v. deep purple | Dark br. | Red br. sol. & ch. quick | Eff. nearly br. | Nil. | — |
| 64 | Anthrasol ... | Evap. c wh. vap. | Cresyl. odor | Orange to br. | Red. br. Cresol odor | Crimson to br. | Nil. | — |
| 65 | Antim. Pot. Tart. | Blackens, grey-wh. sub. | Bl. | Nil. | Ch. quick. | Nil. | (Antim. in bl. residue) | — |

| No. | Sp. Gr. | Sol. Aq. (1 in –) | Sol. Alc. (1 in –). | Litmus. | Fe$_2$Cl$_6$ b & a. boil. | Br. Aq. | Fehling's b. & a. boil. | Mayer's. | Gold Chl. | Acid Picric. | Drag. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 52 | — | 100 | 35 | Mod. ac. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 54 | — | 1 slowly. | Insol. | Mod. ac. | Nil b. buff, pp. a | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 55 | — | 1 | 4 | Neut. | Nil. | Yell. pp. | Pale bl. pp. b. oily drops a. | Wh. pp. | Buff pp. | Yell. pp. | Red-br. pp. |
| 56 | 1·134 | Misc. c. 1, thrown out again c. 2, rediss. in 3 | Misc. | Neut. | Nil. | Nil. | Light blue pp. b, reduct a. | Nil. | Nil. | Nil. | Nil. |
| 57 | 0·815-0·820 | 8 | Misc. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 58 | 0·870-0·880 | Sl. | Misc. | Sl. ac | Nil. | Nil. | Nil. | Br. col. | Nil. | Nil. | Bl. pp. |
| 59 | — | Part sol. | Part sol. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 60 | 0·858 | v. sl. | Misc. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 61 | — | Sl. | 8 | Neut. | Nil. | Yell. pp. | Nil. | Nil. | Br. pp. | Nil. | Nil. |
| 62 | — | 30 | Misc. | Sl. alk. | Br. pp. b. | Wh. pp. | Blue pp. b. diss a. | Nil. | Dark br. pp. | Nil. | Br. pp. to dirty yell. |
| 63 | — | v. sl. | 80 | Neut. | Bl. pp. | Dirty br. pp. | Deep red col. b. and a. | Nil. | P'rple col. | Nil. | Nil. |
| 64 | 0·988 | Sl. | About 12 | Pract. Neut. | Nil. | Wh. pp. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 65 | — | 17 | insol. | Faint ac. | Yell. pp. | Nil. | Nil. | Nil. | Nil. | Nil. | Decolorises. |

| No. | Substance. | Heat. | Heat c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$ | N.P.S. & Hal. | M. Pt. (°C) |
|---|---|---|---|---|---|---|---|---|
| 66 | Antipyrin, see Phenazon | — | — | — | — | — | — | — |
| 69 | Aphrodine ... | M. to br. liq. c, beastly odor, ch. alk. vap. burns | M to br. mass on surface of NaOH | Nil. | Pink-vi. then gr. br. | Gr. yell. | N. & Cl. | |
| 70 | Apiol (Green Liquid) | Goes br. br. dist. | Goes bl. & gives milky dist. pung. & wh. vap. | Br. and viscid. | Ch. c. much eff. | Eff sl. c. br. col. | Nil. | — |
| 71 | Apocodeine HCl. | Smell of burnt feathers | Alk. vap. | Darkens sl. | Ch. | Eff. and turns br. | N. & Cl. | Prt. a 90 dec'm. ov'r 200 |
| 72 | Apomorphine HCl. | Ch. c. wh. vap. | Dark'ns | Nil. | Ch. | Crim. to yel. in 2 mins. | N. Cl. | |
| 73 | Arbutin ... | M. c. sl. eff. then ch. br. dist. & vap. burns. | Froths a lot, darkens vap. burns | Red col. | Dark red and ch. quickly | Red-br. sl. c. eff. | Nil. | 166 |
| 74 | Argentamine | Evap., br. alk. vap. burns, bl. res. | Turns bl. alk. vap. | Eff. & gets hot. | Does not char. | Eff. sl. | N. | — |
| 75 | Argenti Fluorid. | Vap. corrod's glass. | Nil. | Nil. | Wh. vap corrod's glass. | Nil. | F. | Nil. |
| 76 | Argenti Lactas | Ch. vap. burns. | Bl. | Nil. | Ch. | Nil. | Nil. | Nil. |

| No. | Sp. Gr. | Sol. Aq. (1 in-) | Sol Alc. (1 in-) | Litmus. | $Fe_2Cl_6$ b. & a. boil. | Br. Aq. | Fehling's b. & a. boil. | Mayer's. | Gold Chl. | Acid Picric. | Drag. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 66 | — | — | — | — | — | — | — | — | — | — | — |
| 69 | — | Sl. | 130 | Neut. | Nil. | Yell. pp. rediss at first | Wh. pp. b.&a. | Wh. pp. | Vi.br. pp. | Yell. pp. | Red br. pp. |
| 70 | 1.07 | Prac. insol. | Part. | Prac. Neut. | N | Nil. | Nil. | Nil. | Nil. | Nil. | Br. pp. |
| 71 | | 1 | 1 | Neut. | Drkns b. & a. | Dirty br. pp. | Drkns b.drty gr.pp. a. | Dirty buff pp. | Dirty br. pp. | Yell. pp. | Br. pp. |
| 72 | — | 60 | 51 | Neut. | Vi. b. & a. | Red pp. | Nil. | Wh. pp. | Br. rd pp. | Yell. pp. | Br. pp. |
| 73 | — | 10 | 13 | Neut. | Blue b.br.a | Yell. pp. c. excess br. | Nil. | Nil. | Gr. cl. cming slwly to br. pp. | Nil. | Nil. |
| 74 | 1·0815 | Misc. | Misc. | Str'ly alk. | Light br.pp. | Wh. pp. | Blue pp. b. yell.a. | Wh. pp. | Light br. | Yell. pp. | Br. to cream |
| 75 | — | 2 | 3 | Fa'ntly alk. | Wh. pp. | Wh. pp. | Bl. pp. | Yell. pp. | Light choc. pp. | N'dle cryst. on st'nding. | Br. pp. to wh. |
| 76 | — | 18 | 500 | Neut. | Wh. pp. | Wh. pp. | Bl. pp. | Yell. pp. | Light br.pp. | Sl. pp. | Br.pp to wh. |

| No. | Substance. | Heat. | Heat c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$ | N.P.S. & Hal. | M. Pt. (°C) |
|---|---|---|---|---|---|---|---|---|
| 78 | Argonin .. | Ch., br. dist., alk.vap. & nitrogenous odor. | Bl. c. strong alk.vap. | Yell. | Ch. | Nil. | N. | Nil. |
| 79 | Argyrol .. ... | Swells up & Ch. | Alk. vap. | Grey. | Ch. | Wh. & eff. | N. & S. | Nil. |
| 80 | Aristochin ... | M. ch. alk.vap. burns. | M. to br. liq. & floats on Na. | Sl. yell. | Ch. fairly quick. | Sl. yell. | N. | 181-184 |
| 81 | Aristol ... ... | M. to br. c. vi-br. vap. burns. | Goes bl. | Nil. | Vi. vap. & bl. sub. | Darkn's | I. | Nil. |
| 82 | Arrhenal ... | Ch., bl. sub. garlic odor. | Nil. | Nil. | Nil. | Nil. | Nil | Nil. |
| 83 | Arsacetin ... | Ch. black sub. and res. | Nil. | Nil. | Ch. v. slow. | Nil. | N. | — |
| 84 | Arsamin and Atoxyl | Ch. bl. sub. & alk. vap. | Nil. | Nil. | Ch. v. slowly | Nil. | N. | — |
| 86 | Asparagin ... | Red br., alk. vap. | Darkens alk. vap. & nitrogenous smell. | Nil. | Ch. slow. | Nil. | N. | — |
| 87 | Atropine Methyl Brom. *See* MYDRIASINE. | — | — | — | — | — | — | — |

| No. | Sp. Gr. | Sol. Aq. (1 in -) | Sol. Alc. (1 in -). | Litmus. | $Fe_2Cl_6$ b. & a. boil. | Br. Aq. | Fehling's b. & a. boil. | Mayer's. | Gold Chl. | Acid Picric. | Drag. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 78 | — | Opalescent. 6 | Insol. | Neut. | Nil b. br. fr'thy pp. a. | Yell. flocc. pp. | Nil b. dark gr. a. | Nil. | Dirty yell. flocc. pp. | Yell. flock pp. | Br. flocc. pp. |
| 79 | — | All prop. | Insol. | Neut. | Col. blchd b. | Col. blchd & wh. pp. awhile | Turns gr. b. & a. | Nil. | Bl. pp. | Br. pp. | Br. pp. to or. |
| 80 | — | Almost insol. | Sl. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | V. sl. pp. |
| 81 | — | Insol. | V. sl. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 82 | — | 1 | 350 | Fa'rly alk. | Nil b. & a. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 83 | — | 10 | 400 | Faint Ac. | Wh. pp. b. sol. in excess of Reagent, nil. a. | Wh. pp. | Nil. | Nil. | Nil. | Nil. | Br. pp. |
| 84 | — | 6 | 125 | Neut. | Yell. pp. rediss. repptd a. | Wh. pp. | Nil. | Nil. | Br. col. | Nil. | Br. pp. |
| 86 | — | 50 | Insol. | Sl. ac. | Br. col. b. and a. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 87 | — | — |  | — | — | — | — | — | — | — | — |

| No. | SUBSTANCE. | HEAT. | HEAT c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$ | N.P.S. & Hal. | M. Pt. (°C) |
|---|---|---|---|---|---|---|---|---|
| 88 | Atropine and Salts | Base m. and sub. b. ch. salts m. and ch. | Br. pungent alk. vap. burns. | Nil. | Ch. | Nil. | N (S. in Atropine Sulph.) | B'se 115° Sul. 137° |
| 89 | Benzol ... ... | Evap. vap. burns. | Nil. | Nil. | Ch. slowly vap. burns. | Nil. | Nil. | Nil. |
| 90 | Benzopiperaz *vide* PIPERAZ. BENZ . | — | — | — | — | — | — | — |
| 91 | Benzosalin ... | Sub. and ch. | Ch. | Nil. | Ch. | Nil. | Nil. | 75 |
| 92 | Benzosol. ... | M. and evap., vap. burns. | Sl. br. c. vap. burns. | Yell. | Dark gr. and ch. | Nil. | Nil. | 50 to 52 |
| 93 | Betaine HCl... | Part m., ch. c. eff. and alk. vap. burns. | Alk. vap. | Eff. | Eff. not ch. | Nil. | N. Cl. | |
| 94 | Betol. ... ... | M. turns yell. part evap. ch. vap. burns. | Yell. | Nil. | Goes from yell. to gr. bl. and ch. | Nil. | Nil. | 95 |
| 95 | Bismuthi Benzoas | Bl. c. yell. sub. and wh. vap. c. Benzoic odor. | Bl. c. B'nzene odor, vap. burns. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 96 | ,, Citras | Bl. c. bl. sub. | Bl. | Nil. | Eff. and vap. burns ch. slowly. | Nil. | Nil. | Nil. |
| 97 | ,, Oxy-Iodogall. *vide* AIROL | — | — | — | — | — | — | — |
| 98 | ,, Salicyl. ... | Blackens vap. c. odor of Phenol burns. | Bl. | Nil. | Gradually goes br. eff. | Br. in parts only. | Nil. | Nil. |
| 99 | Borovertin ... | Ch. c. strong alk. vap. | Alk. vap. | Nil. | Ch. quick. | Nil. | N. | Nil. |
| 100 | Bromalbacid... | Ch., alk. vap. burns. | Turns br. and alk. vap burns. | Gelatinous. | Ch. | Gelatinous. | Br. N. P. | Nil. |

| No. | Sp. Gr. | Sol. Aq. (1 in -). | Sol. Alc. (1in-). | Litmus. | $Fe_2Cl_6$ b.& a. boil. | Br. Aq. | Fehling's b.& a. boil. | Mayer's. | Gold Chl. | Acid Picric. | Drag. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 88 | — | Base 300, Sulph. ½. | Base 3, Sulph 3. | Base faint, Alk. Sulph Neut. | Nil b. br. pp. a. | Ornge pp. | Blue pp., rediss. b., nil a. | Wh. pp. | Buff. pp. | Yell. pp. | Red. br. pp. |
| 89 | 0·888 | Insol. | 0·33 | Neut | Nil | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 90 | — | — | — | — | — | — | — | — | — | — | — |
| 91 | — | Insol. | 35 | Neut | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 92 | — | Almost insol. | 50 | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 93 | — | 2 | About 20 | Acid. | Nil. | Pp. rediss at first. | Nil. | Nil. | Nil. | Cryst. pp. in conc. Nil in dilute. | Br. pp. |
| 94 | — | Almost insol. | Sl. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 95 | — | Almost insol. | Almost insol. | Sl. acid. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 96 | — | Almost insol. | Insol. | Faint acid. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 97 | — | — | — | — | — | — | — | — | — | — | — |
| 98 | — | Almost insol. | Almost insol. | Neut. | Vi. col. turns br. a. | Yell. pp. | Nil. | Nil. | Nil | Nil. | Nil. |
| 99 | — | 17 | 120 | Sl. alk. | Nil b. red br. pp. a. | Yell. pp. | Nil. | Cryst pp. | Orange pp. | Nil. | Br. bl.pp. |
| 100 | — | Part. sol. | Insol. | Neut. | Nil b. br. pp. a. | Nil. | Nil. | Nil. | Nil. | Yell. pp. | Br. pp. |

| No. | Substance. | Heat. | Heat c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$ | N.P.S. & Hal. | Mt. P. (°C) |
|---|---|---|---|---|---|---|---|---|
| 101 | Bromal-hydrate | M. wh. vap. colors flame green. | Bromoform odor. | Nil. | M. does not mix, yell. dist. | Sl. yell. | Br. | 54 |
| 102 | Bromalin ... | Eff. ch. c. alk. vap. | Wh.alk. vap. c. Pyridin odor burns. | Sl. br | Yell. vap.col. flame gr. | Sl. yell. to br. | Br. N. | 200 Schmdt |
| 103 | Brometone ... | M., sub and ch. c.v. irritating vap. | Vap. burns. | Nil. | Forms red drops v. irritating vap | Nil. | Br. | 167 |
| 104 | Bromocoll ... | Ch. c. nitrogenous odor | Br. c. eff. | Dark'ns sl. | Ch. | Yell.br. c. eff. | Br. N. | Nil. |
| 105 | Bromoform ... | Dist. then ch c. br. vap. Brom. odor. | Dark'ns & vap. flame gr. | Nil. | Goes br. with br. vap. & then colorless. | Nil. | Br. | — |
| 106 | Bromural ... | M. ch., orange sub.and vap. burns. | Str.alk vap. burns, darkens sl. | Nil. | Red br. c. valerian odor, no ch. | Nil. | N. and Br. | 138 to 143 |
| 107 | Butyl Chloral | Sub. totally. | Dark'ns | Nil. | Ch. | Nil. | Br. | 78 |
| 108 | Caffeine... ... | Sub. & m. | Sl. sub. & alk. vap. | Nil. | Yell. slowly, no ch. | Nil. | N. | 236° |
| 109 | Caffeine... Citras | M. ch. c. br. dist. & sl. vap. burns c. Phenol odor. | Alk. vap. & eff. a lot. | Delicate pink. | Eff. & ch. slow. | Nil. | N. | 162° |
| 110 | Caffeine Sodio-Salicyl. | Part m. sub. c. alk. vap. | Alk. vap. & eff. a lot. | Nil. | Ch. slow. | Nil. | N. | Nil. |
| 111 | Calcii Glyceroph. | Ch. acrid vap. burns. | Eff. vap. burns. Sl. blackens. | Nil. | Ch. | Nil. | P. | Nil. |
| 112 | Calcii Lactas. | M. swells & ch. | Eff. vap. burns. | Nil. | Eff. ch. vap. burns c. blue flame. | Nil. | Nil. | Nil. |

| No. | Sp. Gr. | Sol. Aq (1 in -). | Sol. Alc. (1 in-) | Litmus. | $Fe_2Cl_6$ b.& a. boil. | Br. Aq. | Fehling's b. & a. boil. | Mayer's. | Gold Chl. | Acid Picric. | Drag. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 101 | — | 2½ | ½ | Neut | Nil. | Nil. | V. light bl. pp. b. dissolves a. | Nil. | Nil. | Nil. | Nil. |
| 102 | — | 0·6 | 25 | Neut. | Nil. | Yell. pp. | Nil b. sl. reduc a. | Yell. pp. ch'ng-ing to wh | Br. yell. pp. | Cryst. pp. comes slowly. | Red br. pp. |
| 103 | — | 200 | 1 | Neut | Nil. | Nil. | Gr. pp. a | Nil. | Nil. | Nil | Nil. |
| 104 | — | Almost insol. | Part. sol. | Sl. acid. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil |
| 105 | 2 833 | Sl. | Misc. | Neut. | Nil | Nil. | Nil. | Nil. | Nil. | Nil. | Nil |
| 106 | — | Almost insol. | 14 | Neut. | Nil | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 107 | — | 43 | 2 | Neut | Nil. | Nil. | Pp. b nil a. | Nil. | Nil. | Nil. | Nil |
| 108 | — | 80 | 10 | Neut. | Nil. | Nil. | Crys. pp. b., rediss. a. | Nil. | Sl. pp. | Nil. | Br. pp. |
| 109 | — | 32 | 25 | Acid. | Nil b. & a. | Nil. | Crys. pp. b., rediss. a. | Nil. | Sl. pp. | Nil. | Br. pp |
| 110 | — | 2 | 40 | Prac. Neut. | Red-vi. b., pp. a. | Wh. pp. | Nil. | Nil. | Nil. | Nil. | Br. pp. |
| 111 | — | 23 | Almost insol. | Alk. | Nil b., buff pp. a. | Nil. | Nil b., blue pp. a. | Nil. | Nil. | Nil. | Nil. |
| 112 | — | 15 or less when fresh. | Insol. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |

| No. | Substance. | Heat. | Heat c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$ | N.P.S. & Hal. | M. Pt. (°C) |
|---|---|---|---|---|---|---|---|---|
| 113 | **Calcii Saccharas** | Ch. c. caramel odor. | Br. & vap. burns. | Br. | Ch. at once. | Eff. sl. | Nil. | Nil. |
| 114 | **Camph. Monobrom.** | M. c. camph. odor & sub, | Camph. odor vap. burns. | Nil. | Yell. & ch. quick. | Liquefies. | Br. | 76 |
| 115 | **Cannabin Tannas** | Part. m., wh. alk. vap. & br. dist. c. tobacco odor. | Br. c. br, dist. & alk. vap. | Darkens. | Ch. at once. | Eff. yell.-br. | N. difficult to detect. | Nil. |
| 116 | **Cantbaridin** ... | M. sub. vap. burns. | Darkens. | Nil. | Ch. quick. | Nil. | Nil. | 218 |
| 117 | **Capsicin** .... | Boils, irrit. vap. burns. | Irrit. vap. burns. | Ch. at once. | Ch. at once, c. eff. | Nil. | Nil. | — |
| 118 | **Carbamide.** *See* Urea. | — | — | — | — | — | — | — |
| 119 | **Cellotropine** ... | M. to yell. liq. ch. vap. burns. | Goes yell. & eff. a lot. | Goes br.-yell. | Deep red-br. ch. quick. | Yell. | Nil. | 178-184 |
| 120 | **Chinolin** ... | Evaps. & vap. burns. | Vap. burns. | Gets hot & solid. | Br. slow. | Forms crystals slowly. | N. | — |
| 121 | **Chinosol** ... | M. c. eff. | Bl. c. odor like Chin'lin | Nil. | Br. slow. | Eff. sl. gives br. | N,S,. | 172 |
| 122 | **Chloralamid** ... | M. sub. c. chloral odor. | Eff. alk. vap. c. Isonitrile odor. alk. vap. burns. | Nil. | Eff. c. Chloral odor no ch. | Nil. | N,Cl. | 115 |
| 123 | **Chloral Hydras** | M. sub. c. distinctive odor. | Eff. a lot. | Nil. | Irrit. vap. not ch. | Nil. | Cl. | 48-49 |
| 124 | **Chloralose** ... | M. ch. c. br. dist. | Br. c. caramel odor vap. burns. | Nil. | Ch. quick c. Chloral odor. | Nil. | Cl. | 187° |

| No. | Sp. Gr. | Sol. Aq. (1 in –). | Sol. Alc. (1 in–). | Litmus. | $Fe_2Cl_6$ b & a. boil. | Br. Aq. | Fehling's b. & a. boil. | Mayer's. | Gold Chl. | Acid Picric. | Drag. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 113 | — | 10 | Insol. | Alk. | Pp. b., nil a. | Nil. | Nil. | Nil. | Sl. yell. pp. | Nil. | Sl. br. pp. |
| 114 | — | Insol. | 18 | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 115 | — | Sl. | Sl. | Sl. ac. | Black b. & a. | Nil. | Bl.-gr. col. b., gelat. pp. a. | Slight buff pp. | Bl. pp. | Nil. | Red-br. pp. |
| 116 | — | 400 | Sl. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 117 | 0·918 | V. sl. | Misc. | Sl. ac. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Red-br. |
| 118 | — | — | — | — | — | — | — | — | — | — | — |
| 119 | — | V. sl. | 100 | Neut. | Nil. | Nil, | Nil. | Nil. | Nil. | Nil. | Nil. |
| 120 | 1·09 | Sl. | Misc. | Sl. alk. | Nil. | Yell. pp. | Sl. pp. b., nil a. | Wh. pp. | Crm. pp. | Yell. pp. | Red-br. to bl. |
| 121 | — | 1 | Sl. | Sl. ac. | Dark green pp. b. bl., a. | Yell. | Yell. gr. b. & a. | Crm. pp. | Buff pp. | Yell. | Red-br. to bl. |
| 122 | — | 20 | 2 | Neut. | Nil. | Nil. | Nil b. red a. | Nil. | Nil. | Nil. | Nil. |
| 123 | — | 0·25 | 0·2 | Neut. | Nil. | Nil. | Blue pp. b., reduction and smell $CHCl_3$ | Nil. | Nil. | Nil. | Nil. |
| 124 | — | Sl. | 40 | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |

| No. | Substance. | Heat. | Heat c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$ | N.P.S. & Hal. | M. Pt. (°C) |
|---|---|---|---|---|---|---|---|---|
| 125 | Chloretone ... | Wh. sub. & irrit. vap. | Br. vap. burns c. gr. edg.flm. | Nil. | Eff. c. irrit. vap. | Nil. | Cl. | 80 |
| 126 | Chrysarobin (Acid Chrysophanic) | M. ch. & yell. vap. burns | Blackens | Yell. | Deep red ch. quick | Nil. | Nil. | 152-4 |
| 127 | Cimicifugin ... | Br. dist. vap. burns | Nil. | Br. | Ch. quick | Br. | N. | Nil. |
| 128 | Cinchonidine | M. ch. & alk vap. burns | Orange br. & floats on soda | Nil. | Ch. slow | Nil. | N. | 202 |
| 129 | Cinchonine ... | M. ch. c. burnt feather odor & alk. vp. bns. | Alk. vp. Pyridne odor | Nil. | Ch. slow | Nil. | N. | 255 |
| 130 | Cinnamic Aldehyde | Evap. res. ch. vap. burns | Br. c. aromat. vap. burns | Ch. immed. | Ch. at once | Goes darker & solid | Nil. | — |
| 131 | Citarin ... | Ch. | Nil. | Nil. | Ch. | Nil. | Nil. | Sftens at 82 & ch at 250 |
| 132 | Citrophen ... | M. c. decomp. yell. sb. vap. burns | Alk. vap. burns | Nil. | Eff. ch. slowly vap. burns | Blue | N. | 170c decomp |
| 133 | Citric Acid *vide* Acid | — | — | — | — | — | — | — |
| 134 | Cocaine (*Off.*) ... | M. c. yell. dist. ch.&alk. vap. burns | Turns buff col. c. alk. vap. | Nil. | Turns br. ch. | Nil. | N. | 98 |
| 135 | Cocaine Hydrochlor (*Off.*) | M. c. eff. to yell. lq. ch. & alk. vap. burns | Buff col. c. alk. vap. | Eff. | Turns br. ch. | Nil. | N. & Cl. | 182c decomp |
| 136 | Codeine Hydrochlor | M. to br. liq. c. eff. ch. br. dist. & vap. burns | Br. c. alk. vap. | Eff. darkens sl. | Eff. trns sl. vi. then br. & ch. | Eff. c. yell-br. col. | N.&Cl. | 255 |

| No. | Sp. Gr. | Sol. Aq. (1 in –). | Sol. Alc. (1 in –). | Litmus. | $Fe_2Cl_6$ b & a. boil. | Br. Aq. | Fehling's b. & a. boil. | Mayer's. | Gold Chl. | Acid Picric. | Drag. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 125 | — | 200 | 1½ | Neut. | Nil. | Nil. | Nil b. gr. to yell. pp. a. | Nil. | Nil. | Nil. | Nil. |
| 126 | — | V. sl. | V. sl. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 127 | — | Sl. | 1 | Neut. | Nil. b stringy pp. a. | V. sl. pp. | Nil. b. sl. red pp. a. | Nil. | Nil. | Nil. | Sl. br. pp. |
| 128 | — | V. sl. | 20 | Prac. neut. | Nil. | Yell. pp. | Nil. | Wh. pp. | Buff pp. | Yell. pp. | Red br. pp. |
| 129 | — | V. sl. | 175 | Prac. neut. | Nil. | Yell. pp. | V. sl. pp. b. floccy wh. pp. a. | Wh. pp. | Buff pp. | Yell. pp. | Red br, pp. |
| 130 | 1·057 | Sl. | Misc. | Prac. neut. | Nil. | Sl. floccy pp. | Nil. | V. sl. pp. | Nil. | Nil. | Red br. pp. |
| 131 | - | 1 | Sl. | Faint Acid | Br. pp. b. | Yell. pp. | Nil. | Nil. | Yell. pp. | Nil. | Br. pp. |
| 132 | — | 180 | Sl. | Acid | Sl. pp. b. deep red col. & pp. | Yell. pp. | Nil. | Nil. | Vi. pp. | Nil. at first yell. u'l'c'le crysts form slwly | Nil at first grad. goes vi. |
| 133 | — | — | — | — | — | — | — | — | — | — | — |
| 134 | — | Sl. | 10 | Alk. | Nil. | Yell. pp. | Nil. | Wh. pp. | Buff pp. | — | Red br. pp. |
| 135 | — | 0 5 | 2½ | Neut. | Nil. b. sl. br. pp. a. | Yell. pp. | Wh. pp. b. to oily drops a. | Wh. pp. | Yell. pp. | Yell. pp. | Red br. pp. |
| 136 | — | 30 | 26 | Neut. | Nil. | Yell. pp. redis at first | Nil. | Wh. pp. | Lt. br. pp. | Yell. pp, | Red br. pp |

| No. | Substance. | Heat. | Heat c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$ | N.P.S. & Hal. | M. Pt. (°C) |
|---|---|---|---|---|---|---|---|---|
| 137 | Colchicine ... | M. c. d'comp. ch. alk. vap. burns. | Turns deep br. c. alk. vap. | Br.-yell. | Br. to deep red. | Deep vi. | N. | 143 decom at 147 |
| 138 | Colchicine Salicyl | M. c. d'comp. ch. alk. vap. burns. | Deep. br. c. alk. vap. | Br. yell. | Br. to deep red. | Deep vi. | N. | 55-60 |
| 139 | Collargol ... | Br. sub. & alk. vap. burns. | Alk. vap. burns. | Nil. | Nil. | Eff. and dirty grey col. | N. | Nil. |
| 140 | Coninæ HBr... | M. and evaps. c. br. dist. | Alk. vap. burns. | Br. yell. | Red br. no ch. c. br. vap. | Nil. | N. and Br. | 214 |
| 141 | Coryfin ... ... | Evaps. entirely c. Menth'l odor. | Vap. c. odor of Menth'l burns. | Br. | Red br. and ch. quick. | Nil. | Nil. | — |
| 142 | Coumarin ... | M. and evap. vap. burns. | Yell. vap. burns. | Nil. | Br. no ch. | Nil. | Nil. | 67 |
| 143 | Cresylic Acid *vide* Acid | — | — | — | — | — | — | — |
| 144 | Cryogenin ... | M. ch. str. alk. vap. burns. | Alk. vap. burns. | Sl. pink | Deep blue and ch. | Eff. and br. col. | N. | 170 |
| 145 | Cutebin ... | M. ch. c. br. dist. & vap. burns | Yell. mass floats on soda. | Deep red. | Deep red ch. quick. | Br. to gr. | Nil. | 128 |
| 147 | Dermatol ... | Goes bl. vap. burns. | Goes bl. | Nil. | Turns red c. wh. pp. then bl. | Dark. gr. & eff finally br. | Nil. | Nil. |

| No. | Sp. Gr. | Sol. Aq (1 in –). | Sol. Alc. (1 in–). | Litmus. | $Fe_2Cl_6$ b & a. boil. | Br. Aq. | Fehling's boil. b. & a. | Mayer's. | Gold Chl. | Acid Picric. | Drag. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 137 | — | 1 | 1 | Neut. | Dark col. b. drkns a., c. sl. dirty gr. pp. | Buff. pp. | Gr. col. b. and a. | Sl. pp. | Buff pp. | V. sl. yell. pp. | Br. pp. |
| 138 | — | Sl. | 1 | Acid. | Vi. col. b. and a. | Buff pp. | Gr. col. b. and a. | Sl. pp. | Buff pp. | V. sl. yell. pp. | Br. pp. |
| 139 | — | Misc. | Insol. | Neut. | Dirty br. pp. bleached by excess of reagent | Yell. pp. | Dark red almst bl., turns bl'ck, a. | Bl. pp. | Bl. pp. | Dark br. pp. | Orange pp. |
| 140 | – | 2 | 3 | Neut. | Nil. | Yell. pp. | Nil b, opal which disappears a. | Cream pp. | Orange red pp. | Nil. | Dark dirty br. pp. |
| 141 | 0·960 | V. sl. | Misc. | Neut. | Nil b. v. sl. pp. a. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 142 | — | Sl. | 7 | Neut. | Nil. | Deep yell. pp. | Nil. | Nil. | Nil. | Nil. | Bl. resinous pp. |
| 143 | — | — | — | — | — | — | — | — | — | — | — |
| 144 | — | 100 | 25 | Neut. | Nil. | Nil. | Gr. col. b, reduction a | Nil. | Bl. br. pp. | Nil. | Br. yell. crysts form sl'wly |
| 145 | — | V. sl. | Sl. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 147 | — | Insol. | Insol. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |

| No. | Substance. | Heat. | Heat c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$ | N.P.S. & Hal. | M. Pt. (°C) |
|---|---|---|---|---|---|---|---|---|
| 148 | Dextrose (Commercial). | Ch. odor of burnt sugar, br. sub. vap. burns. | Goes br. | Nil. | Ch. immed. | Nil. | Nil. | Nil. |
| 149 | Digitoxin | M. ch. yell. dist. vap. burns. | Goes dark & floats on soda as a bl. mass. | Ch. to br. mass. | Chars immed. | Yell. to vi. | Nil. | 240 |
| 150 | Dionin | M.c. eff. & gives fish odor. ch. vap. burns. | M. to br. sub-stance on surface of soda. | Eff. sl. | Eff. br. tinge chnging to faint blue ch. slowly. | Eff. sl. & goes red. br. | N. & Cl. | 121 |
| 151 | Diplosal | M. & gives wh. sub. ch. & gives Phenol odor & vap. burns. | Floats as insol. powder on surface of soda. | Nil. | Goes br. does not ch. | Nil. | Nil. | 142 |
| 152 | iuretin | Ch. Phenol odor, wh. dist. & alk. vap. burns. | Eff. str. alk. vap. | Nil. | Br. slowly, does not ch. | Nil. | N. | Nil |
| 153 | Dormiol (*See* AMYLENE-CHLORAL.) | — | — | — | — | — | — | — |
| 154 | Duotal | M. & evaps. almost entirely vap. burns. | Br. up. tube & vap. burns. | Nil. | Light gr. turns darker & ch. | Nil. | Nil. | 86 |
| 155 | Dymal | Yell. ch. c. Phenol odor & vap. burns. | Nil. | Nil. | Br. but does not ch. | Nil. | Nil. | Nil. |
| 156 | Elaterin | M. to yell. liq. c. eff. br. dist. vap. burns | Yell. then br. mass on soda | Br. | Deep red br. & ch. | Nil. | Nil. | 209 |
| 157 | Emetina | Part. m. & ch. alk. vap. burns | Floats as br. mass on soda | Dirty br. | Br. & ch. slowly | Br. | N. | 69 |

| No. | Sp. Gr. | Sol. Aq (1 in –). | Sol. Alc. (1 in–) | Litmus. | $Fe_2Cl_6$ b.& a. boil. | Br. Aq. | Fehling's b.& a. boil. | Mayer's. | Gold Chl. | Acid Picric. | Drag. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 148 | — | Misc. | Sl. | Neut. | Nil. | Nil. | Nil. Str. reduct. a. | Nil. | Nil. | Nil. | Nil. |
| 149 | — | Pract. insol. | 140 | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 150 | — | 10 | 25 | Neut. | Nil. b. sl. br. pp. a. | Yell. pp. rediss at first. | Light blue pp. b. oily drops a. | Wh. pp. | Br. yell. pp. | Yell. pp. | Br. pp. |
| 151 | — | Very sl. | 15 | Neut. | Nil. | Sl. yell. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 152 | — | 2 (c.f. E.P.) | V. sl. | Str. alk. | Vi. col. b. vi. pp. a. | Wh. pp. rediss at first. | Nil. | Nil. | Br. color & v. sl. pp. | Nil. | Deep br. pp. turning lightr |
| 153 | — | — | — | — | — | — | — | — | — | — | — |
| 154 | — | Nil. | Abt. 200 | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 155 | — | Very sl. | Sl. | Faint ac. | Deep vi. col. b. & a. | Yell. pp. turning wh. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 156 | — | Insol. | 160 | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 157 | — | Sl. | 3 | Sl. alk. | Nil. | Sl. dark yell. pp. | Nil. | Very sl. wh. pp. | Very sl. dirty cr'am pp. | Sl. yell. pp. | Dark red br. pp. |

| No. | SUBSTANCE. | HEAT. | HEAT c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$ | N.P.S. & Bal. | M. Pt. (°C) |
|---|---|---|---|---|---|---|---|---|
| 158 | Enesol (Hyd., ARSEN. SALICYL. | Bl. c. metal'ic sub. & garlic odor | Bl. & a grey deposit creeps up tube | Nil. | Red br. eff. quckly darkns | Nil. | Nil. | Nil |
| 159 | Ephedrine HCl. | M. & gives arom. odor, ch | Alk. vap. | Eff. sl. | Eff. ch. quick | Nil. | N. & Cl. | 211 |
| 160 | Epicarin ... | M. to br. liq. ch. & vap. burns c. odor of Naph. | Red, qu'ckly to yell. | Br. | Deep br. red & ch. slowly | Eff. & goes red | Nil. | 199 |
| 161 | Ergotinine ... | Bl. c part fusion | Floats as bl. mass on Soda & gives alk. vap. | Gr. br. | Gr. br. & ch. quckly | Br. | N. | Blk. at 210 |
| 162 | Erythrol Nitrate | M. & then explodes | Nil. | Nil. | Br. then wh. again, does n't ch. | Nil. | N. This test must be used c. caution | 61 |
| 163 | Eucain Lactate | M. & evaps., vap. burns | Froths a lot, & vap. burns | Nil. | Ch. quickly | Nil. | N. | 155 |
| 164 | Eucalyptol ... | Evaps., vap. burns & eucalyptus odor | Sl. br., & vap. burns | Br. | Red br. & ch, to a resino's solid | Nil. | Nil. | — |
| 165 | Eumydrine ... | M. eff. ch. & br. dist., & alk. vap. burns | Br., & gives inflam. alk. vap. | Nil. | Br., & turns purplsh | Nil. | N. | 149-150 |
| 166 | Euphthalmine Base | M. & distils, giving Pyridine odor vap. burns | Alk. Pyridinic vap. | Nil. | Ch. | Nil. | N. | 112 |

| No. | Sp. Gr. | Sol. Aq. (1 in –). | Sol. Alc. (1 in –). | Litmus. | $Fe_2Cl_6$ b. & a. boil. | Br. Aq. | Fehling's b. & a. boil. | Mayer's. | Gold Chl. | Acid Picric. | Drag. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 158 | — | Sl. sol. | Alm. insol. | Mod. ac. | Vi. col. b. & a. | Wh. pp. | Nil b. sl. opal. a. | Nil. | Nil. | Nil. | Sl yell. pp. |
| 159 | — | 7 | 8 | Neut. | Nil. | Yell. pp. rediss & repp. by exce's | Nil. | Nil. | Nil. | Nil. | Red br. pp. |
| 160 | — | V. sl. | 7 | Faintly ac. | Vi. cl. b., br. col. a. | V. sl. pp. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 161 | — | Insol. | Sl. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 162 | — | Insol. | Abo't 90 | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 163 | — | 5 | 8 | Faintly alk. | Sl. cloud b., sl. br., pp. a. | Wh. pp. | Wh. pp. b. separates as oily drops a. | Wh. pp. | Cr'am pp. | Yell. pp. | Red br. res. pp. |
| 164 | 0·93 | Slightly | Misc. | Neut. | Nil b., sl. opal a. | V. sl. pp. rediss at first | Nil. | Nil. | Nil. | Nil. | Br. pp. |
| 165 | — | 1 | 4 | Neut. | Nil. | Wh. pp. | Nil. | Wh. pp. | Cr'am pp. | Nil. | Dull red pp. |
| 166 | — | Sl. sol. | 80 | Alk. | Nil. | Yell. pp. | Nil. | Wh. pp. | V. sl. yell. pp. | Nil. | Br pp |

| No. | Substance. | Heat. | Heat. c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$. | N.P.S. & Hal. | M. Pt. (°C) |
|---|---|---|---|---|---|---|---|---|
| 167 | **Euresol** ... .. | Bright red nr. edge of liq. Acetic odor, vap. burns & ch. | Yell. but if not thoroughly mixed patches of red | Yell.-gr. | Olive gr. ch. slowly | Br. | Nil. | — |
| 168 | **Eurobin** ... | M. & ch. vap. burns | Bl. | Red & turns to br. | Red sol. quick ch. | Br. | Nil. | Abt 94 |
| 169 | **Europhen** ... | M. to red br. liq. first vi. & then br. vap. | Floats as br. mass on soda | Bl.-br. | Ch. quick vi. vap. | Dark br. | I. | 80 |
| 170 | **Exalgin**... .. | M. & sub. | Benzol odor, vap. burns | Nil. | Nil. | Nil. | N. | 101 |
| 171 | **Fluorescein** ... | Part m. turns br gr. ch. & swells up | Vi. to bl. then yell. | Nil. | Yell. dissolves, turns red-br. | Turns yell. immediately | Nil. | — |
| 172 | **Formaldehyde** | Boils, gives gas burns blue, sl. res. ch. | Goes br quick before heating. Vap. burns | Forms glassy looking solid. | Ch. quick | Eff. after a time, goes. gr. at edges | Nil. | — |
| 173 | **Formamint** (Tabs.) | Part m. & ch. irrit. vap. burns | Br. Vap. burns | Slowly goes br. | Ch. quick | Nil. | Nil. | — |
| 174 | **Fuchsin**... ... | Part m. & br. vap. burns | Separates fused on surf. of NaOH | Red br. | Ch. quick | Dark br. | N. & Cl. | — |
| 175 | **Gelseminine** (MERCK) | M. ch. br. dist. and alk. vap. burns | Floats on NaOH as br. mass | Dkns. sl. | Red & ch. slowly | Gr. col. | N. | 158 160 Merck |
| 176 | **Glycosal** ... | Sub. | Nil. | Nil | Ch. | V. faint red-vi. | Nil. | 63 |
| 177 | **Glycogen** ... | Ch. br.-yell. vap. burns | Br. c. alk. vap. burns. | Nil. | Ch. immed. | Nil. | N. & S (Impurities only) | — |
| 178 | **Griserin** *vide* LORETINE | — | — | — | — | — | — | — |

| No. | Sp. Gr. | Sol. Aq. (1 in –). | Sol. Alc. (1 in–) | Litmus. | $Fe_2Cl_6$ b. & a. boil. | Br. Aq. | Fehling's b. & a. boil. | Mayer's. | Gold Chl. | Acid Picric. | Drag. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 167 | 1·200 | Sl. | Misc. | Neut. | Br. vi. b. br. a. | Yell. pp rediss at first | Nil b. gr. & then br. pp. a. | Nil. | Bluish strks. come very sl'wly | Nil. | Red br. pp. |
| 168 | — | Pract. insol. | Sl. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 169 | — | Insol. | 120 | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 170 | — | 60 | Freely. | Alk. | Nil. | Wh. pp. | M. & floats on top | Nil. | Nil. | Nil. | Br. pp. |
| 171 | — | Less than 1. | 2 | Turns blue Litm paper gr -yl. | Br. pp. b. Br. pp. a. | Orange. red pp. | Br. col. b and a. | Nil. | Bl.-br. pp. | Yell. pp. rediss | Bl. pp. goes br. |
| 172 | 1·08 | Misc. | Misc. | Sl. ac. | Nil. | Nil. | Nil b. dark red pp. a. | Nil. | Nil. | Nil. | Nil. |
| 173 | - | Part sol. | Part sol. | Sl. acid | Nil b. sl. br. pp. a. | Nil. | Nil b. red pp. a. | Nil. | Nil. | Nil. | Nil. |
| 174 | - | Slight. | Abt. 20 | Neut. | Nil. | Almost bl. pp. floats, liq. decol. | V. dark pp. b. and a. | Dark pp. sol. turns vi. pink | Dark pp. sol. turns purple | Br. pp. sol. yell. | Dark pp. sol. gr. |
| 175 | — | Sl. | Sol. | Alk. | Nil. | Yell. pp. | Nil b. dirty gr. col & sl. reduct a. | Wh. pp. | Light br. pp. | Yell. pp. | Br. pp. |
| 176 | — | Sl. |  | Neut. | Deep vi. | Wh. pp. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 177 | — | About 2 incomplete | Almost insol | Faint alk. | Nil b. Sl. pp. a | Sl. wh. pp. | Nil. | Nil. | Nil. | Yell. pp. | Sl. red br. pp. |
| 178 | — | — | — | — | — | — | — | — | — | — | — |

| No. | SUBSTANCE. | HEAT. | HEAT c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$ | N.P.S. & Hal. | M. Pt. (°C) |
|---|---|---|---|---|---|---|---|---|
| 179 | **Guaiacol** ... | Evap. c. character. odor vap. burns | Br. | Sl. br.-yell. | Br. & ch. | Dk. br. c. violent reaction | Nil. | — |
| 180 | **Hedonal** .. | M. evaps. vap. burns. | Alk. vap. burns | Nil. | Yell. ch. quick. | Nil. | N. | 75 |
| 181 | **Helmitol** ... | Ch. alk. vap. br. dist. & vap. | Sl. alk. vap. | Nil. | Ch. quick c. eff. | Nil. | N. | — |
| 182 | **Heroin Base** .. | M. then ch. alk. vap. burns. | Deep orange sl. alk. vap. | Sl. br. | Ch. fairly quick | Yell. | N. | 169 |
| 183 | ,, **HCl** ... | M. to br. liq. c. sl eff. alk vap. burns. | Deep orange froths a lot sl. alk. vap. | Sl. br. c. sl. eff. | Ch. fairly quick | Yell. | N. & Cl. | 233 |
| 184 | **Hetraline** .. | Orange col. then ch. and gives orange sub. and alk. vap. burns | Vi. then br. and gives alk. vap. | Red. br. | Ch. at once c. eff. | Sl. br. slowly. | N. | — |
| 185 | **Hexamethylen-tetramine** | Sub. entirely S. m. or ch. | Wh. sub. and sl. alk. vap. | Nil. | Ch. vap. burns | Nil. | N. | — |
| 186 | **Holocain HCl** | M. yell. ch., yel. dist. vap. bns gr. fine | M. br. liq. floats | Sl. eff. | Diss'lvs. c. sl. eff. ch. quick | Nil. | N. Cl. | 186–189 |
| 187 | **Homatropine** | M. colorless, then ch. br. dist. alk. vap. burns | Eff. a lot, alk. vap. burns | Nil. | Ch. quick | Nil. | N. | 98 |
| 188 | **Hydrastine** | M. ch. alk. vap. burns | Br. yell. & floats | Nil. | Deep plum col. ch. | Br. | N. | 132 |
| 189 | **Hydrastinine HCl** | M. to yell. liq. ch. br. dist. vap. burns | Br. c. eff. alk. vap. | Eff. Yell. | Eff. yell. to deep red | — | N. Cl. | 6-117 |
| 190 | **Hyd. Succinas** | Ch. and gives grey sub. | Bl. | Nil. | Sms. to ch. gets light c. wh. pp. | Dark'ns sl. | Nil. | — |

| No. | Sp. Gr. | Sol. Aq. (1 in -). | Sol. Alc. (1 in -). | Litmus. | $Fe_2Cl_6$ b. & a. boil. | Br. Aq. | Fehling's b. & a. boil. | Mayer's. | Gold Chl. | Acid Picric. | Drag. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 179 | 1·116 | Sl. | Misc. | Neut. | Dk. br. b. Bl. pp. a. | Dk. ornge pp. | Nil. b sl red pp. a. | Nil. | Bl. pp. | Nil. | Br. pp. |
| 180 | — | Sl. | 2¼ | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 181 | — | 7 | Sl. | Acid | Red br. pp. b. and a. | Yell. pp. | V. sl. reduc. a. | Cream pp. | Ornge pp. | Cryst. pp. after few secs. | Br. pp. |
| 182 | — | Sl. | 44 | Sl. Alk. | Nil. | Yell. pp. | Nil. | Sl. wh. pp. | Sl. buff. pp. | Sl. yell. pp. | Red br. pp. |
| 183 | — | 2⅓ | 13 | Neut. | Nil. | Yell. pp. | Wh. pp. b. clotting. a. | Wh. pp. | Dirty yell. pp. | Yell. pp. | Red br. pp. |
| 184 | — | 10 | 20 | Alk. | Bl. color b, red br. pp. a. | Yell. pp. rediss at first | Nil b. Gr. col. a. | Nil. | Ornge pp. going bl. | Cryst. pp. after few secs. | Red br. pp. im'ed. trning gr. and yell. |
| 185 | — | 1 | 8 | Alk. | Br. pp. b. Red br. a. | Yell. pp. | Nil. | Nil. | Dirty yell. | Cryst. pp. after few secs. | Br. pp. tning bl. |
| 186 | — | 55 | 8 | Faint alk. | Nil. | Yell. pp. | Wh. pp. b. a. clotting | Wh. pp. | Buff pp. | Yell. pp. | Br. pp. |
| 187 | — | V. sl. | Abt. 3 | Alk. | Nil. | Yell. pp. | Nil. | Wh. pp. | Buff pp. | Nil. | Br. |
| 188 | — | V. sl. | 150 | Neut. | Nil. | Sl. cloud. | Nil. | Sl. cloud. | Nil. | Nil. | Sl. br. pp. |
| 189 | — | Less than 1 | Abt. 5 | Neut. | Nil. | Yell. pp. | Nil b. rd. pp. & gr. col. a. | Cr'am wh. pp. | Buff. pp. | Yell. pp. | Red br. pp. |
| 190 | — | V. sl. | V. sl. | Neut. | Nil. | Nil. | Nil. | Yell. pp. turns red | Nil. | Nil. | Yell. pp. |

| No. | SUBSTANCE. | HEAT. | HEAT c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$ | N.P.S. & Hal. | M. Pt. (°C) |
|---|---|---|---|---|---|---|---|---|
| 191 | **Hyd. Succinimidum** | Ch. grey sub. vap. burns sl. cyanide odor | Bl. c. strong alk. vap. | Nil. | Ch. fairly quick | Dark'ns sl. | N. | Nil. |
| 192 | **Hyd. Thymol-Acetas** | Ch. c. Acetic, then Thymol odor vap. burns. | Yell. then bl., Thymol odor. | Nil. | Yell. then purple & ch. | Deep red br. after little time. | Nil. | Nil |
| 193 | **Hyoscine HBr.** | M. cb. br. dist. & alk. vap. burns. | Br. & floats on soda. | Eff. & sl. br. | Ch. quick. | Nil. | N., Br. | — |
| 194 | **Hyoscyamine Sulph.** (*Off.*) | M. ch. & alk. vap. burns. | Br. floats on soda. Alk. vap | Nil. | Ch. quick. | . | N. & S. | 206 |
| 195 | **Hypnal.** ... | M. c. Choral odor ch. & give alk. & inflam. vap. | Bl. & strong Isonitrile odor. | Nil. | Eff. turns from yell. to br. not ch. |  | N. & Cl. | 67—68 |
| 196 | **Ichthalbin** ... | Part. m.c. burnt feather odor, br. dist. alk. vap burns. | Br. alk. vap. burns. | Bl. | Deep vi. br. & ch. | Bl | N. S. | Nil. |
| 197 | **Ichthargan.** ... | Ch. & swells c. wh. pungent fumes. | Bl. to br., Ichthyol odor. | Nil. | Ch. quick. | Nil. | S. | — |
| 198 | **Ichthoform** ... | Ch. c. Ichthyol odor like burning rubber. | Wh. alk. vap. | Dissolves to bl. sol. | Ch. | Nil. | S. N. | — |
| 199 | **Indigo** ... ... | Odor of HCN. Alk. vap. burns. | Br. c. alk. vap. | Nil. | Colorless & gives wh. pp. | Nil. | N. | — |

| No. | Sp. Gr. | Sol. Aq. (1 in -). | Sol. Alc. (1 in-) | Litmus. | $Fe_2Cl_6$ b.& a. boil. | Br. Aq. | Fehling's b.& a. boil. | Mayer's. | Gold Chl. | Acid Picric. | Drag. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 191 | -- | 23 | V. sl. | Alk. | Nil. | Nil. | Sl. opalesnce, b. wh. pp. a. | Yell. pp. turns or'nge | Nil. | Nil. | Br. pp. turning cream |
| 192 | — | Insol. | Sl. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 193 | — | 3 | 14 | Neut. | Nil. | Yell. pp. | Nil. | Wh. pp. | Br. yell. pp. | Yell. pp. | Red br. pp. |
| 194 | — | 0.5 | 4 | Neut. | Nil. | Yell. pp. | Nil. | Wh. pp. | Yell. pp. | Yell. pp. | Red br. pp. |
| 195 |  | 10 | Abt. ½ | Neut. | Deep red col. b., & a. | Yell. pp. re-diss. at first. | Nil b. reduced a. | Sl. wh. cloud. | Buff pp. | Yell. pp. | Br. |
| 196 | — | V. sl. | Insol. | Neut. | Nil b. sl. br. pp. a. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 197 | -- | 0.5 | Sl. | Neut | Muddy br. pp. b. & a. | Muddy br. pp. | Dirty blue, pp. b., turn'g to bl. a. | Yell. pp. | Br. pp. | Nil. | Br. pp. turning lighter |
| 198 | — | Sl. | Sl. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 199 | — | V. sl. | Insol. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |

| No. | Substance. | Heat. | Heat c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$ | N.P.S. & Hal. | M. Pt. (°C) |
|---|---|---|---|---|---|---|---|---|
| 200 | Indigo-Carmine | Gives off water, nothing else characteristic. | Dark brown. | Dissolves to intense bl. sol. | Eff. sl. & dissolves to blue sol. & ch. | Eff. sl. dissolves to yell. br. sol. | S. N. | — |
| 201 | Iodoform ... | | Smell sufficiently characteristic. | | | | | |
| 202 | Iodol ... ... | Bl. & gives bl. sub. & vi. vap. | Alk. vap. goes gr.-grey to br. | Gr. Darkening slowly. | Light gr., turns dark then bl. c. vi. vap. & metallic sub. | Red br. slowly. | I. N. | — |
| 203 | Iohydrin ... | Br. c. oily dist. vi. vap. burns, & pungent res. ch. | Vap. burns, pungent odor & goes br. | Darkens sl. | Bl. gives vi. vap. & bl. metallic sub. | Nil. | I. | — |
| 204 | Isopral ... ... | M. & evaps. completely. | Br. & froths a lot, & vap. burns. | Nil. | Nil. | Nil. | Cl. | 49° |
| 205 | Jothion, *vide* IOHYDRIN | — | — | — | — | — | — | — |
| 206 | Lactophenin... | M. then ch. and wh. alk. vap. burns. | M. to yell. liq. on surface & vap. burns. | Nil. | Ch. slowly vap. burns. | Turns yell. br. | N. | 116 |
| 207 | Lævulose ... | M. to br. liq. c. caramel odor and ch. vap. burns | Deep br vap. burns then nearly wh. | Goes br. slowly. | Ch. almost immediately. | Nil. | Nil. | — |
| 208 | Lecithin ... | M. c. characteristic odor. | Wh. alk. vap. | Chars slowly. | Carbonises. | Nil. | N (small q'antity P.) | — |

| No. | Sp. Gr. | Sol. Aq (1 in -). | Sol. Alc. (1 in -). | Litmus. | $Fe_2Cl_6$ b. & a. boil. | Br. Aq. | Fehling's b. & a. boil. | Mayer's. | Gold Chl. | Acid Picric. | Drag. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 200 | — | Sl. | Insol. | Neut. | Deep blue pp. b., br. a. | Dark gr. pp. dissolving to br. sol. | Gr. col. b., blue col. & sl. red pp. a. | Deep blue pp. | Col. discharged sl'wly | Nil. | Dark gr. pp. |
| 201 | — | — | — | — | — | — | — | — | — | — | — |
| 202 | — | V. sl. | 21 | Neut. | Nil. | Nil. | Nil b. sl. red pp. a. | Nil. | Nil. | Nil. | V. sl. |
| 203 | — | Sl. | Misc. | Neut. | Nil. | Sl. yell. pp. redissolves at first. | Nil. | Sl. wh pp. | Sl. yell. pp. | Nil. | br. pp. |
| 204 | — | 32 | 0·5 | Neut. | Nil. | Nil. | Nil b. br. pp. a. | Nil. | Nil. | Nil. | Nil. |
| 205 | — | — | — | — | — | — | — | — | — | — | — |
| 206 | — | 330 | 15 | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 207 | --- | Less than 0.5 | About 16 | Neut. | Nil. | Nil. | Nil b., red pp. a. | Nil. | Nil. | Nil. | Nil. |
| 209 | — | Sl. | 30 misc. c. 1 but thrws out c. more. | Sl. acid. | Nil. | Dil'te emulsion gives orange pp. | Br. pp. | Nil. | Nil. | Nil. | Orange br. pp. |

| No. | Substance. | Heat. | Heat c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$ | N P.S. & Hal. | M. Pt. (°C) |
|---|---|---|---|---|---|---|---|---|
| 210 | **Lycetol** ... ... | Part.m. and ch. & gives br. alk. vap. burns | Alk. vap. | Nil. | Goes br. and ch. | Nil. | N. | 250 Hager. |
| 211 | **Magnes Ricinoleas** *Syn.* MARICOL | Ch. and pungent vap. burns | Sl. arom. oily odour | Sl. eff. | Eff. ch., quickly | Sl. eff. | Nil. | — |
| 212 | **Malachite Green** | Part m. goes gr. up tube & then br. vap. burns | Goes br. and then wh. | Turns reddish | Eff. sl. and ch. quick | Turns red colour | N. & Cl. | — |
| 213 | **Mannitol Nitrate** | M. goes br. and expldes | Br. gives minute flashes of light then goes almost wh. | Nil. | Yell. does not ch. | Nil. | N. c. difficulty | 113 |
| 214 | **Maretin** ... | M. sub. and alk. vap. burns | Br. and eff. a lot turns wh. again | Turns yell. | Ch. slowly | Eff. and turns red br. | N. | 178 |
| 215 | **Methylene Blue** | Swells and ch. c. sulphur odor | M. and floats on surf. of soda & colors top of tube vi. | Sl. eff. and dark gr. | Eff. a lot and ch. quick | V. dark green | N.S. & Cl. | — |
| 216 | **Migrainine** ... | M. then ch. and gives br. alk. vap. burns | M. on surf. of soda tus red br. Magnta up sides of tube alk. vap. | Nil. | Yell. does not ch. | Nil. | N. | 101-105 |
| 217 | **Morphine HCl** | Ch. c. br. dist. | Orange br. c alk. vap. burns | Sl. eff. | Ch. quick | Red c. sl. eff. & changes to yell. | N. & Cl. | — |
| 218 | **Mydriasine** ... | M. c. sl. eff. ch. & gives. br. dist. & irrit. vap. | Red br. and gives alk. vap. | Eff. and turns sl. yell. | Ch. quick | Nil. | N. & Br. | 214 |

| No. | Sp. Gr. | Sol. Aq (1 in -). | Sol. Alc. (1in-). | Litmus. | $Fe_2Cl_6$ b. & a. boil. | Br. Aq. | Fehlings b.&a. boil. | Mayer's. | Gold Chl. | Acid Picric. | Drag |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 210 | — | 2 | Sl. | Sl. acid. | Nil b. and a. | Yell. pp. redissolves at first. | Nil b., and a. | Nil. | Blue bl. col. comes slowly. | Yell. pp. | Br. bl. pp. |
| 211 | — | Almost insol. | V. sl. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 212 | — | 2 | Abt. 30 | Indefinite | Gr. col. b. Gr. br. a | Dark gr. pp. | Nil b, choc. pp. a. | Dark gr. pp. | Dark gr. pp. | Dark gr. pp. | Dark dirty br. pp. |
| 213 | – | Almost insol. | Sl. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 214 | - | V. sl. | Abt. 60 | Neut. | Nil. | Yell. pp. cming slwly | Gr. sol. b. dirty gr.pp. a. | Nil. | Gr.bl, pp. | Nil. | Br.bl. film |
| 215 | — | About 6 | Sl. | In-d'finte | Vi. blue b., navy blue a. | Bl. pp. and sol. almost colorless | Nil b. bl.pp. a. | Copious blue pp. | Bl. pp. | Red. bl. pp. | Copious bl. pp. |
| 216 | — | 0 8 | 1 | Prac. neut. | Deep red br. b., and a | Yell. pp. re-dissolving | Nil. | Wh, pp. | Dull. yell. pp. | Brght yell. pp. | Ornge red pp. |
| 217 | — | 24 | About 55 | Neut. | Blue b. br. yell. a. | Yell. pp. rediss at first | Nil. | Yell. wh. Gelatinous pp. | Yell. br. pp. turns dark'r | Yell. pp. | Red br. pp. |
| 218 | — | 1 | 8 | Neut. | Nil. | Yell pp. | Nil. | Wh. pp. | Red. yell. pp. | Red, yell. pp. | Red br. pp. |

| No. | Substance. | Heat. | Heat c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$. | N.P.S. & Hal. | M. Pt (°C) |
|---|---|---|---|---|---|---|---|---|
| 221 | Nicotine ... | Evaps. c. naus. odor | Characteristic choking Nicot. odor | Light red | Red then carbonises | Nil at first but pinkish later | N. | — |
| 223 | Nitrobenzene | Dist. ch. sl. vap. burns c. smoky flame | Goes br. vap. burns | Nil. | Ch. slowly | Nil. | N. | — |
| 224 | Novaspirin ... | Part. m. then ch. yell. sub vap. burns | Yell. and eff. a lot | Nil. | Ch. fairly quick | Nil. | Nil. | — |
| 225 | Novocain ... | M. to clear liq. ch. c. alk. vap. and naus. odor | Br. to gr. yell. and gives alk. vap. | Eff. | Eff. and goes sl. yell. does not ch. | Nil. | N. Cl. | 150 |
| 226 | Nuclein .. ... | Ch. br. alk. vap. burns | Red-br. eff. a lot alk. vap. | Almost bl. gummy mass | Ch. at once | Br. gummy mass. | N. & P. | Nil. |
| 227 | Orexin TANNAS | Ch. part m. & gives br. dist. sl. alk. vap. burns. | Goes yell. | Goes a dirty gr. br. | Deep vi & then ch. quick | Turns red br. & eff. sl. | N. | Nil. |
| 228 | Orphol ... ... | Goes bl. c. red-br. sub. and vap. burns. | Goes bl. | Dark br. | Goes inky bl. c. wh. pp. | Goes bl. | Nil. | Nil. |
| 229 | Orthoform New | M. to Yell. liq. ch. br. dist. & alk. vap. burns. | Goes vi. then gr. c. sl. alk. vap. | Nil. | Br. & ch. slowly. | Blue bl. changing to red-br. | N. | 141 |

| No. | Sp. Gr. | Sol. Aq. (1 in-). | Sol. Alc. (1in-). | Litmus | $Fe_2Cl_6$ b. & a. boil. | Bs. Aq. | Fehling's b. & a. boil. | Mayer's. | Gold Chl. | Acid Picric. | Drag. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 221 | – | Misc. | Misc. | Alk. | Br. pp. b. darker pp. a. | Yell. pp. rediss at first | Nil. | Wh. pp. | Buff pp. | Yell. pp. | Br. pp. |
| 223 | 1·201 | Sl. | 1 | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Light br. pp. |
| 224 | — | Sl. | 5 | Sl. ac. | Sl. br. frothy pp. a. | Sl. op'lescence coming slwly | Nil. | Nil. | Nil. | Nil. | Nil. |
| 225 | | Less than 1 | 10 | Neut. | Nil. | Yell. pp. rediss finally wh. pp. | Pale blue pp. b., oily drops a. | Wh. pp. | Br. pp. | Yell. pp. | Red-br. pp |
| 226 | — | V. sl. | Insol. | Sl. ac. | Nil. b. frothiness a. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 227 | — | Sl. | 55 | Neut. | Dark gr. tinge b., sl. br. pp. a. | Yell. pp. | Bluish op'lescence b., Nil. a. | Wh. pp | Dark buff pp. | Yell. pp. | Red-br. pp. |
| 228 | — | V. sl. | Sl. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 229 | — | V. sl. | 7 | Neut. | Vi. br. col. b., gr. br. pp. a. | Dirty gr. br. pp. | Nil. b., br. red pp. a. | Nil. | Dark gr. pp. | Nil. | V. sl. red br. pp. slowly. |

| No. | SUBSTANCE. | HEAT. | HEAT c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$ | N.P.S. & Hal. | M. Pt. (°C) |
|---|---|---|---|---|---|---|---|---|
| 230 | Paraform ... | Part m. and sub, vap. burns | Br. and vap. burns | Nil. | Ch. slowly vap. burns | Eff. violently after a while | Nil. | 171 |
| 231 | Paraldehyde... | Evaps. vap. burns | Vap. burns | Nil. | Ch. almost immed. | Nil. | Nil. | 10-12 |
| 232 | Pelletierine (SOLID) | M. ch. and alk. vap. burns. | Floats as br. liq. on surface, vap. burns | Nil. | Goes br and ch. slowly | Nil. | N. | 46 |
| 233 | Petrol Ether | Evaps. vap. burns. | Vap. burns | Nil. | Ch. slow vap. burns. | Nil. | Nil. | — |
| 234 | Phenacetin .. | M. and volatilises almost completely vap. burns | Br. vap, burns | Nil. | Ch. fairly quick | Red br. col. | N. | 135 |
| 235 | Phenalgin ... | Part m. and eff. dense sub. ch. alk. vap. burns | Strong alk. vap. burns | Eff. strong | Goes dark no ch. | Eff. strong | N. | — |
| 236 | Phenazone ... | M. then ch. and br. alk. vap, burns | Red br. & goes red vi. up tube and alk. vap. burns | Nil. | Yell. no ch. | Nil. | N. | 113 |
| 237 | Phenocoll HCl. | Part m. and ch. br. sub. alk. vap. burns | M. to br. liq. on soda | Eff. sl. | First br. then colorless and ch. | Bright yell. | N. Cl. | — |
| 238 | ,, Salicyl | M. to br. liq. ch. alk. vap. burns | M. to br. liq. on soda | Nil. | First br. then colorless then br. and ch. | Red. br. eff. | N. | 160-165c decomp |

| No. | Sp. Gr. | Sol. Aq. (1 in –). | Sol. Alc. (1 in –). | Litmus. | $Fe_2Cl_6$ b & a. boil. | Br. Aq. | Fehling's b. & a. boil. | Mayer's. | Gold Chl. | Acid Picric. | Drag. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 230 | — | V. sl. | Sl. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 231 | 0·988 | 10 | Misc. | Sl. acid | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 232 | — | 4 | 3 | Alk. | Br. pp. b. and a. | Wh. pp. | Nil. | Nil. | Nil. | Yell. pp. | V. dark br. pp. |
| 233 | 0·670 to 0·700 | Insol. | 4 | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 234 | — | Sl. | 20 | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 235 | — | Part | Part | Alk. | Br. pp. b. darkening a. | Wh. pp. and eff. | Nil. | Nil. | Sl. dark pp | Nil | Nil. |
| 236 | — | 1¼ | 1 | Neut. | Deep red b. and a. | Yell. pp. re-diss. | Nil. | Nil. | Buff. pp. | Yell. pp. | Red br. pp. |
| 237 | — | 18 | 34 | Neut. | Nil. | Yell. pp. re-diss. first. | Vi. col. b. vi. br. pp. a. | Wh. pp. | Nil. | Yell. pp. turns cryst. | Br. red pp. |
| 238 | — | Sl. | 50 | Neut. | Vi. col. b., & a. | Wh. pp. | Nil b. sl. vi. br. pp. a. | Nil. | Nil. | Yell. crysts form slwly. | Br. red pp. |

| No. | Substance. | Heat. | Heat c. NaOH | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$ | N P.S. & Hal. | M. Pt. (°C) |
|---|---|---|---|---|---|---|---|---|
| 239 | **Phenolphthalein** | M. to br. liq. ch. odor of Phenol. vap. burns | Bl. then deep purple change to dirty orange | Deep red | Red to br. ch. slowly | Yell. | Nil. | 250 |
| 240 | **Phloridzin** ... | M. c. sl. eff. ch. and gives br dist. and vap. burns | Yell. then br. finally grey c. much eff. | Yell. | Red br. and ch. quick | Bl. to red-br. | Nil. | 107 resldfies & m agn. at 170 |
| 241 | **Physostigmine** | M. gives v. irritating vap ch. alk. vap. burns | Br. & alk. vap. | Sl. yell. | Br. yell. changes to gr. & ch. | Yell. | N. | 75 |
| 242 | **Physostigmine Sulph.** | M. gives irritating inflam. & alk. vap. | Br. & gives alk. vap. | Sl. yell. | Br. yell. turns gr. & chars. | Yell. | N.S. | 140 |
| 243 | **Phytin** ... | Ch. br. dist. | Orange red, then gr. Vap. burns | Nil. | Orange pink then br. & ch. | Nil. | P. | Nil. |
| 244 | **Picrotoxin** ... | M. ch. br. dist. vap. burns | Orange yell. to br. c. inflam. gas | Orange yell. | Orange yell. to deep red br. & ch. | Nil. | Nil. | 192 |
| 245 | **Pilocarpine** ... | Boils, ch. & alk. Vap. burns. | Floats as oily liq. on soda. | Nil. | Ch. slowly. | Nil. | N. | — |
| 246 | **Pilocarpine Nitrate** | Ch. suddenly alk. Vap. burns. | Floats as oily liq. on soda. | Nil. | Ch. slowly. | Nil. | N. | — |

| No. | Sp. Gr. | Sol. Aq. (1 in–). | Sol. Alc. (1 in–) | Litmus. | $Fe_2Cl_6$ b.&a. boil. | Br. Aq. | Fehling's b.& a. boil. | Mayer's. | Gold Chl. | Acid Picric. | Drag. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 239 | — | V. sl. | 10 | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 240 | — | V. sl. | 4½ | Neut. | Vi. br. b., br. col. a. | Sl. yell. pp. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 241 | — | Sl. | 2 | Alk. | Nil. | Yell. pp. | Nil. b., br. col. & red pp. a. | Wh. pp. | Br. pp. and purplish sol. | Yell. pp. | Red pp. |
| 242 | — | Less than 1. | Less than 2. | Faint alk. | Br. col. b., decolorises & light br. pp. a. | Yell. pp. rediss at first. | Nil. b., br. col. & red pp. a. | Wh. pp. | Fawn pp. turning to bl. c. purple sol. | Yell. pp. | Red br. pp. turning or'nge |
| 243 | — | Less than 1 but throws out on diluting. | Insol. | Acid. | Wh. pp. b., & a. | Nil. | Gelatinous pp. b., almst. redlss Th'wn out agn a. | Nil. | Nil. | Nil. | Sl. Yell pp. |
| 244 | — | Sl. | 13 | Neut. | Nil. | Nil. | Nil. b. sl. pp. a. | Nil. | Nil. | Nil. | Nil. |
| 245 | — | V. easily. | Misc. | Alk. | Sl. cloud b., nil. a. | Pale yell. pp. rediss at first. | Nil. | Wh. pp. | Crmy yell. pp. | Sl. yell. pp. | Br red pp |
| 246 | — | 9 | 50 | Neut. | Nil. | Yell. pp. rediss. at first. | Nil. | Wh. pp. | Crmy yell. pp. | Yell. pp. | Br. red pp. |

| No. | Substance. | Heat. | Heat c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$ | N.P.S. & Hal. | M. Pt. (°C) |
|---|---|---|---|---|---|---|---|---|
| 247 | **Piperazin** ... | M. & evaps. completely & alk. vap. burns. | Cryst sub & alk. vap. burns. | Combines c. hissing noise. | Nil. | Nil. | N. | 104-107 |
| 248 | **Piperazin Benz.** | M. & evaps. vap. burns. | Sl. alk. vap. | Nil. | Darkens sl. does not ch. | Nil. | N. | Sftens 105 M. abt. 167 |
| 249 | **Piperidine Tart.** | M. ch. wh. then yell. vap. c. celery odor. | Alk. vap. | Nil. | Ch. | Nil. | N. | Abt 80 |
| 250 | **Podophyllin** *vide* PODOPHYLLOTOXIN | — | — | — | — | — | — | — |
| 251 | **Podophyllotoxin** | Part m. ch. br. dist. and vap. burns | Yell. br. | Br. mass gr-yell. on edges | Br. yell. to deep br. and ch. | Eff. and goes choc. br. | Nil. | — |
| 252 | **Proponal** ... | M. c. sl. eff. c. wh. sub. vap. burns | Alk. vap. peppermint odor | Sl. eff. | Ch. slowly | Nil. | N. | 147 |
| 253 | **Protargol** ... | Ch. br. dist. alk. vap. burns | Bl. wells and alk. vap. burns | Nil. | Ch. almost immed. and vap. burns | Nil. | N. | — |
| 254 | **Pyramidon** ... | M. ch. & alk. vap. burns c. isonitrile odor. | Goes br. and gives strong isonit. odor. | Nil. | Light r. not char. | Eff. and goes br. | N. | — |

| No. | Sp. Gr. | Sol. Aq. (1 in -). | Sol. Alc. (1 in-) | Litmus. | $Fe_2Cl_6$ b.&a. boil. | Br. Aq. | Fehling's b.&a boil. | Mayer's. | Gold Chl. | Acid Picric. | Drag. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 247 | — | 2 | 3 | Alk. | Red br. pp. b., & a. | Yell. pp. rediss. at first. | Nil. | Sl. wh. pp. | Red br. pp. | Sl. yell. pp. | Bl. pp. turning yell. |
| 248 | | 100 | 10 | Acid. | Buff pp. b. & a | Yell. pp. rediss. at first. | Nil. | Nil. | V. sl. buff. pp. | Yell. pp. | Red br. pp. |
| 249 | — | Less than 1. | About 30 | Acid. | Nil. | Yell. pp. | Nil. b. reduction slowly a. | Wh. crysts form slowly | Nil. | Nil. | Br. pp. |
| 250 | — | — | — | — | — | — | — | — | — | - | — |
| 251 | | V. sl. | Misc. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 252 | -- | V. sl. | 7 | Neut. | Nil. | Nil. | Nil. b. sl. floccy wh. pp. a. | Nil. | Nil. | Nil. | Nil. |
| 253 | — | Imperfectly. | V. sl. | Sl. alk. | Sl. opalescence b., fr'thy a. | Wh. pp. | Nil. b. br. col. a. | Lightens in col. | Nil. | Yell. floccy pp. | Br. pp. turning wh. |
| 254 | — | 20 | 2 | Alk. | Vi col. disappearing b., br. pp. a. | Vi col. | Nil. | Wh. pp. | Vi. col. | Yell. pp. rediss. | Br. pp. |

| No. | SUBSTANCE. | HEAT | HEAT c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$ | N.P.S. & Hal. | M. Pt. (°C) |
|---|---|---|---|---|---|---|---|---|
| 256 | **Quinine** ... | M. ch. c. br. dist. & alk. vap. burns. | Orange to gr. yell., & floats as br. mass | Nil. | Yell. & ch. slowly. | Strong fluorescence. | N. | 172 |
| 257 | ,, ,**Sulphate** (*Off.*) | M. to red liq. ch. c. vi. vap. then br. alk. vap. burns. | Orange to gr. yell., floats as br. mass | Nil. | Yell. & ch. slowly. | Strong fluorescence. | N.S. | 205 wh. dr'd ov'r $H_2SO_4$ |
| 258 | **Resorcin** ... | M. & sub. vap. burns, c. sweet odor. | Red br. and changes to dirty white. | Yell. gr. | Gr. & ch. quick c. much spirt'ng | Yell. to br. slowly. | Nil. | 110 C |
| 259 | **Sabromin** ... | Part m. ch. c. gr. br. dist. vap. burns | Oily odor and darkens sl. | Sl. br. | Br. and ch. c. much eff. | Oily | Br. | Abt 230 |
| 260 | **Saccharin** .. | M. to clear liq. ch. wh. cryst. sub. & vap. burns c. arom. odor. | Alk. vap. eff. consid. | Nil. | Darkens sl. no ch. | Nil. | N.S. | 220 |
| 261 | **Sajodin** ... | M. to br. liq. c. vi. vap. br. dist. vap. burns | Sl. oily odor and floats as wh. mass on soda. | Sl. br. | Red ch. gives vi. vap. and froths a lot. | Oily and darkens sl. | I. | Abt 206 strt at 170 |
| 262 | **Salacetol** ... | M. and ch. vap. burns. | Orange col. then fades into muddy col. | Pinkish after a while. | Red. vi. and chars. quick. | Nil. | Nil. | 67 |
| 263 | **Salicin** ... | M. then ch. c. caramel odor. | Br. caramel odor vap. burns. | Red col. | Ch. | Nil. | Nil. | 198-201 |

| No. | Sp. Gr. | Sol. Aq. 1 in -) | Sol. Alc. (1 in -) | Litmus. | $Fe_2Cl_6$ b. & a. boil. | Br. Aq. | Fehling's b. & a. boil. | Mayer's. | Gold Chl. | Acid Picric. | Drag |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 256 | — | V. sl. | 1 | Sl. alk. | Nil. | Yell. pp. | Wh. pp. b. Nil a. | Wh. pp. | Cre'm pp. | Yell. pp. | Br. red pp. |
| 257 | -- | 800(*Off.*) | 100 | Neut. | Nil b. br. pp. a. | Yell. pp. redis. at first. | Wh. pp. b. Nil a. | Wh. pp. | Cre'm pp. | Yell. pp. | Br. red pp. |
| 258 | — | 1 | 0.5 | Neut. | Blue-vi. b. de-colorised a. | Yell. pp. redis. at first | Nil b. gr. col. to br. pp. a. | Nil. | Grad. goes gr. | Nil. | Nil |
| 259 | – | Insol. | Pract. insol. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 260 | — | Sl. | 25 (*Off.*) | Acid | Nil. b. Sl. br. pp. a. | Nil. | Nil. b. sl. red pp. a. | Nil. | Nil. | Nil. | Nil. |
| 261 | — | Insol. | Pract. insol. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 262 | — | Sl. | 14 | Sl. acid. | Vi. b. br. col. a. | Wh. pp. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 263 | — | 28 | 50 (*Off.* 60.) | Neut. | Nil. | Nil. | Nil. | Sl. opal. | Nil. | Nil. | Nil. |

| No. | SUBSTANCE. | HEAT. | HEAT c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$ | N.P.S. & Hal. | M. Pt. (°C) |
|---|---|---|---|---|---|---|---|---|
| 264 | **Salipyrin** ... | M. to clear liq. ch. br. dist. and sl. alk. vap. burns. | Mag'nts sub. then br. alk. vap. & ch. | Darkens v. sl. | Br. and chars sl. | Darkens v. sl. | N. | 90 |
| 265 | **Sal Limonis** ... | Ch. and sl. vap. burns. | Greyish and froths a lot. | Nil. | Ch. quick. vap. burns | Nil. | Nil. | — |
| 266 | **Salocoll** *vide* PHENOCOLL SALICYL | — | — | — | - | — | — | — |
| 267 | **Salol** ... ... | M. boils then ch. vap. burns c. Phenol odor. | Turns yell. | Yell. | Ch. slowly | Nil. | Nil. | 43 |
| 268 | **Salophen** ... | M. turns yell. and ch. vap. burns. | Vi. and gives blue col. up sides of tube. | Nil. | Red vi. slowly | Nil. | N. | 180-185 |
| 269 | **Saloquinine** ... | M. ch. alk. vap burns. | Yell. then br. | Nil. | Ch. fairly quick. | Nil. | N. | 139 |
| 270 | **Santalol** ... | Evaps. vap. burns c. characteristic odor. | Yell. br. vap. burns. | Deep red. br. | Deep red br. and chars. quick | Sl. br. | Nil. | — |
| 271 | **Santonin** ... | M. to clear liq. ch. gives br. dist. & vap burns. | Red then br. vap. burns. | Nil. | Yell. to br. and ch. | Nil. | Nil. | 170 |
| 272 | **Santyl** ... ... | Part evaps. c. characteristic odor, vap. burns, res. ch. | Yell. br. and vap. burns. | Red br. | Red br. ch. quick. | Sl. dark | Nil. | — |
| 273 | **Sodii Cacodyl** | Part m. bl. metallic sub., inflam. gas, c. garlic odor. | Eff. a lot | Nil. | Nil. | Nil. | Nil. | — |

| No. | Sp. Gr. | Sol. Aq. (1 in ·) | Sol. Alc. (1 in·) | Litmus. | $Fe_2Cl_6$ b.& a. boil. | Br. Aq. | Fehling's b.& a. boil. | Mayer's | Gold Chl. | Acid Picric. | Drag. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 264 | — | 200 | 4½ | Acid | Vi. col. b. and a. | Wh. pp. | Nil. | Wh. pp. | Sl. buff. pp. | V. sl. yell. pp. | Red br. pp. |
| 265 | — | About 40. | Sl. | Acid | l. pp. b. and a. | Ni | Nil. | Nil. | Nil. | Nil. | Sl. br. pp. |
| 266 | — | — | — | — | — | — | — | — | — | — | — |
| 267 | — | V. sl. | 10 | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 268 | — | V. sl. | Sl. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 269 | — | V. sl. | 120 | Neut. | Nil. | Nil. | Nil. | Sl. opalesce. | Nil. | Nil. | Sl. br. pp. |
| 270 | — | Pract. insol. | Misc. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 271 | — | Sl. (*Off.*) | 40 (*Off.*) | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 272 | 1·012 | Pract. insol. | Abt. 40. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 273 | — | 0·5 | 1 | Alk. | Nil. | Nil. | Nil. | Nil. | Sl. buff pp | Nil. | Red br. pp. |

| No. | SUBSTANCE. | HEAT. | HEAT c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$ | N.P.S. & Hal. | M. Pt. (°C) |
|---|---|---|---|---|---|---|---|---|
| 274 | **Sodii Glyceroph** | Ch. and irrit. vap. burns. | Darkens sl. inflam. gas. | Eff. sl. | Ch. quick | Eff. sl. | P. | — |
| 275 | ,, **p-amino-phenyl Arsonas** (*see* 84) | — | — | — | — | — | — | — |
| 276 | ,, **Acetyl do.** (*see* 83) | — | — | — | — | — | — | — |
| 277 | ,, **Salicyl** ... | Ch. c. odor of Phenol. | Nil. | Nil. | Goes dark, does not ch. | Nil. | Nil. | — |
| 278 | ,, **Sulphocarb** | Decrepitates, ch. vap. burns c. Phenol odor. | Nil. | Nil. | Ch. slowly | Nil. at first, turns red slowly | S. | — |
| 279 | ,, **Sulphoricinas** | Evaps. ch. & vap. burns | Eff. a lot and soapy odor | Br. col. | Deep red and ch. | Vi. br. | S. (Cl. impurity) | — |
| 280 | ,, **Taurocholas** | Part m., swells up and alk. vap. burns. | Br. & gives alk. vap. | Nil. | Red c. green fluorescence, and ch. quick. | Nil. | N.S. | — |
| 281 | **Sozoiodol Soda** | Bl., c. br. dist. and vi. vap. | Br. yell. | Sl. pink | Red, then bl. & gives vi. vap. and bl. sub. | Slowly. Bl. c. orange edges. | I.S. | Nil. |
| 282 | **Spartein Sulph.** | M. boils ch. Pyridinic odor. alk. vap. burns. | Alk. vap. & mousy odor. | Nil. | Nil. | Nil. | N.S. | First abt. 62 & ag. 140 |
| 283 | **Stovaine** ... | M. volatilises ch. c. odor of varnish | Wh. fumes amylic odor. | Eff. no color. | Diss. & ch. on boiling. | Nil. | N. & Cl. | 168 |
| 284 | **Strophanthin** | Swells ch. c. br. dist. vap. burns. | Pinkish then br. vap. burns. | Em. gr. changing to br. (U.S.) | Ch. almost at once. | Br. | Nil. | Begins to fuse at 170 m. at 190 compltly. |

| No. | Sp. Gr. | Sol. Aq. (1 in -). | Sol. Alc. (1 in -) | Litmus. | $Fe_2Cl_6$ b.&a. boil. | Br. Aq. | Fehling's b. & a. boil. | Mayer's. | Gold Chl. | Acid Picric | Drag. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 274 | — | 0.33 slowly. | Sl. | Alk. | Dark buff pp. b.& a. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 275 | — | — | — | — | — | — | — | — | — | — | — |
| 276 | — | — | — | — | — | — | — | — | — | — | — |
| 277 | — | 0 83 | 5½ | Sl. ac. | Vi. col b., vi. pp. a. | Wh. pp. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 278 | — | 5 | 150 | Neut. | Vi.col b., br.col & pp. a. | Decolorised. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 279 | — | Misc. | Misc. | Alk. | Buff pp.br. turns br. & m. a. | Yell. pp. | Nil. b. froths a. | Nil. | Nil. | Nil. | Yell. br. pp. |
| 280 | — | 0·5 | About 2 | Alk. | Mud. gelatinous pp. b., br. a. | Resinous greyish pp. | Gr. col. b. red pp. slowly a. | Nil. | Nil. | Nil. | Br. resinous pp. |
| 281 | — | 14 | 15 | Acid | Vi.col b., bl. pp. & f. vap.a. | Nil. | Nil. | Rosettes of wh. needl. crysts | Sl. br. | Nil. | Or. c. minute needl. crysts |
| 282 | — | Less than 0·5 | 6 | Ac. | Nil b. Lt.br. pp. a. | Yell. pp. redis. at first. | Wh. pp.b., red-oily drops a. | Wh. pp. | Buff pp. | Yell. pp. | Red br. pp. |
| 283 | — | 13 | 3 | Pract neut. | Nil. | Yell. pp. | Reduces on boiling. | Wh. pp. | Yell. pp. | Yell. pp. | Buff pp. |
| 284 | — | Less than 1. | Abt. 1. | Neut. | Nil.b. lt. br. pp. a. | Nil. | Nil.b. red br. pp. a. | Nil. | Nil. | Nil. | Nil. |

| No. | SUBSTANCE. | HEAT. | HEAT c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$ | N.P.S. & Hal. | M. Pt. (°C) |
|---|---|---|---|---|---|---|---|---|
| 285 | **Strychnine** .. | M. to br. liq. & alk. vap. burns. | Bright red & floats on surface. | Nil. | Ch. slowly. | Nil. | N. | 268 |
| 286 | **Stypticin** .. | Deep red & m. partly ch. & br. alk. vap. burns. | Red c. nauseous odor, then br. alk. vap. burns. | Eff. & darkens sl. | Deep magenta slowly. Does not ch. | Br. orange. | N. & Cl. | Abt 191 Hager (Pt. 125) (see also text |
| 287 | **Styptol** ... ... | M. to deep red liq. Ch. br. dist. & alk. vap. burns. | Br. c. nauseous odor & alk. vap. | Gr. yell. | Magenta & does not ch. | Orange. | N. | 98 |
| 288 | **Styracol** ... | M. to clear liq. goes br. c. yell. sub. & vap. burns. | Yell. & gives peculiar odor. Vap, burns. | Orange col. | Orange to gr.-br. and ch. | Nil. | Nil. | 130 Hager) |
| 289 | **Sucrose** (CANE SUGAR) | M. to yell liq. c. characteristic odor, ch. & vap burns. | Br. & vap. burns. | Sl. yell. slowly. | Ch. almost at once. | Nil. | Nil. | 160 |
| 290 | **Sulphonal** ... | M. to wh. liq. c. a. pp. in it. Ch. gives cryst. sub. vap. burns c. sl. garlic odor. | Darkens sl. gives inflam. gas & sl. garlic odor. | Nil. | Red br. & ch. quick. | Nil. | S. | 126 |
| 291 | **Tannalbin** .. | Ch. c. odor of burnt feathers Br. alk. vap. burns. | Br. c. odor of burnt feathers alk. vap | V. dark br. | Ch. immediately. | Br. & swells up. | N & S. | – |

| No. | Sp. Gr. | Sol. Aq. (1 in -). | Sol. Alc. (1 in -) | Litmus. | $Fe_2Cl_6$ b.& a. boil. | Br. Aq. | Fehling's b. & a. boil. | Mayer's. | Gold Chl. | Acid Picric. | Drag. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 285 | — | V. sl. | 150 | Neut. | Nil. | Yell. pp. | Nil. | Wh. pp. | Buff pp. | Yell. pp. | Nil. |
| 286 | — | Less than 0·5 | 3 | Neut. | Nil. | Dark yell. pp. | Gr. col. b., red pp. a. | Yell. pp. | Buff pp. | Yell. pp. | Red-br. pp. |
| 287 | — | 0·5 | 5 | Faint alk. | Br. pp. b. & a. Sol. in excess of Reagent. | Yell. pp. | Nil b., gr. col. & red pp. a. | Cream pp. | Buff pp. | Yell. pp. | Red br. pp. |
| 288 | — | Insol. | Sol. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 289 | — | Less than 0·5 | Abt. 120 | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 290 | — | Sl. | 50 | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 291 | — | Sl. | Sl. | Sl. acid. | Bl. col. b. Br. pp. a. | Nil. | Nil. | Nil. | Dark dirty br. pp. | Nil. | Nil. |

| No. | SUBSTANCE. | HEAT. | HEAT c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$ | N.P.S. & Hal. | M. Pt. (°C.) |
|---|---|---|---|---|---|---|---|---|
| 292 | **Tannigen** ... | Part m. & yell. br. vap. burns | Yell. | Nil. | Deep vi. and ch. | Red br. | Nil. | (Semdt 190° C.) |
| 293 | **Tannoform** ... | Ch. c. br. dist. & odor of Tannin. Vap. burns. | Br. then orange then red br. | Nil. | Int'nsly blue, then ch. | Br. c. sl. eff. | Nil. | — |
| 294 | **Terpineol** ... (DISTILLATE FROM TERPINOL.) | Evaps. ent'r'ly, vap. burns. | Vap. burns. | Red-br. | Ch. v. quick. | Orange pink. | Nil. | |
| 295 | **Terpin Hydrate** | M. evaps. c. inflam. vap. & wh. cryst. sub. | Vap. burns. | Yell. br. | Yell. to orange red & ch. | Orange pink. | Nil. | 116 |
| 296 | **Tetronal** ... | M. to colorless liq. evaps. Vap. burns c. garlic odor. | Inflam. gas eff. a lot. | Nil. | Throws out br. pp. before ch. | Nil. | S. | 85 |
| 297 | **Theobromine** | M. to colorl'ss liq. sub. res. ch. c. alk. vap. | Bl. sl. c. strong alk. vap. | Nil. | Yell. but does not change. | Nil. | N. | Abt 300 |
| 298 | **Theobromine Aceto Salicyl** | M. c. eff. to br. liq. wh. sub. acetous ch. and vap. burns. | Darkens sl. alk. vap. burns | Nil. | Dark red br., no ch.<br>Benzoic and Acetic odor. | Nil. | N. | — |
| 300 | **Theophylline** | M. to yell. liq. sub. res. ch. and gives alk. vap. | Bl. sl. and alk. vap. burns. | Nil. | Yell. does not ch. | Nil. | N. | 266 |

| No. | Sp. Gr. | Sol. Aq. (1 in -) | Sol. Alc. (1 in ) | Litmus. | $Fe_2Cl_6$ b.&a. boil. | Br. Aq. | Fehling's b.&a. boil. | Mayer's. | Gold Chl. | Acid Picric. | Drag. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 292 | — | V. sl. | Sl. & goes resinous. | Sl. ac. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 293 | — | Sl. | About 3 | Neut. | Bl. col. b. br. pp. a. | Nil. | Nil. | Nil. | Vi. col. | Nil. | Nil. |
| 294 | 0·944 | Sl. | Misc. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Br. pp. |
| 295 | — | Sl. | 14 | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 296 | — | V. sl. | 15 | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 297 | — | V. sl. | Sl. | Neut. | Nil. | Nil. | Nil. b. v. sl. br. pp. a. | Nil. | Nil. | Nil. | Sl. red br. pp |
| 298 | — | Sl. | Sl. | Sl. ac. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 300 | — | Sl. | 90 | Neut. | Nil. | Cryst. pp. v. slowly. Nil first. | Nil. | Nil. | Nil. | Nil. | Br. bl. pp. |

| No. | Substance. | Heat. | Heat c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$ | N.P.S. & Hal. | M. Pt. (°C) |
|---|---|---|---|---|---|---|---|---|
| 301 | **Theophylline Sodium Acetate** | Part m. and ch. alk. vap. burns. | Alk. vap. burns. | Nil. | Yell. does not change. | Nil. | N. | — |
| 303 | **Thigenol** | Eff. a lot. vap. burns. | A solid br. mass on surface of soda c. oily odor. | Nil. | Ch. c. eff. | Nil. | S. | — |
| 304 | **Thioform** | Red & ch., gry wh. sub. & bl. res | Gr. yell. | Grey. | Gr. & ch. | Br. | S. | — |
| 305 | **Thioresorcin** | Ch. yell. sub. & vap. burns. | Gr. then orange yell. | Gr. grey. | Dirty gr. & ch. | Eff. & goes dark br. | S. | — |
| 306 | **Thiosinamin** | M. to colrless liq. pungent garlic odor ch. alk. vap. burns. | Salmon col. changing to yell. alk vap. burns. | Nil. | Yell. to red-br. & ch. | Nil. | N. & S. | 74 |
| 307 | **Thymol** | M. evaps entirely aromatic vap. burns. | Pungent characteristic odor. | Nil. | Ch. slowly | Eff. & gives reddish oil. | Nil. | 44 |
| 308 | **Tiodin** | Ch. alk. vap. burns c. garlic odor | Eff. a lot, goes salmon pink and alk. vap. burns. | Br. bl. | Pinkish vi. c. vi. vap. br. dist. and garlic odor. | Br. bl. | N.S.I. | — |
| 309 | **Toluol** | Evaps. entirely vap. burns. | Vap. burns. | Nil. | Br. and ch. | Nil. | Nil | — |
| 310 | **Tribromphenol** | M. ch. gives wh. sub. and irritating vap. | Ch. | Nil. | First m. and then ch. & c. br. irritating vap. | Br. after a time. | Br. | 85 |

| No. | Sp. Gr. | Sol. Aq. (1 in -). | Sol. Alc. (1 in -) | Litmus. | $Fe_2Cl_6$ b.& a. boil. | Br. Aq. | Fehling's b. & a. boil. | Mayer's. | Gold Chl. | Acid Picric. | Drag |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 301 | — | 20 | Sl. | Str'ng alk. | Light br.pp. b. dark bl.pp. a. | Nil., red-br c. excess of *Reagent*. | Nil.b. and a. | Nil. | Br. col. | Nil. | Dark br.pp. |
| 303 | 1·062 | Misc. | Sl. | Alk. | Grey br.pp. b. dark br. pp. a. | Bl. pp. | Gr. col. b. and a. | Nil. | Dirty mud. pp. | V. sl. pp. | Br. pp. |
| 304 | — | V. sl. | V. sl. | Neut. | Pale vi.col. b., br. col. a. | Nil. | Nil. | Nil. | N l. | Nil. | Nil. |
| 305 | — | V. sl. | V. sl. | Acid. | Nil b. sl. br. pp. a | Nil. | Nil.b. sl. vi. br. pp. a. | Nil. | Nil. | Nil. | Nil. |
| 306 | — | 18 | 2 | Neut. | Red col. b.,br. pp. a. | Yell. pp. redis. and giving wh. opalescence. | Light blue pp. b., bl. pp. a. | Wh. pp. | Buff pp. redis. | Nil at first, sl. pp. a. | Or. yell. pp. |
| 307 | — | 1,500 | 0·375 | Yell. pp. | Nil. | Wh. pp. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 308 | — | Easily. | Misc. | Neut. | Nil b. sl.pp. a. | Br. pp. | Pale blue pp. b. cream pp. a. | Wh. pp. | Br.bl. pp. | Yell. pp. at first rediss | Red br. pp. |
| 309 | — | V. sl. | 1 | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 310 | — | Ins l. | 3 | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |

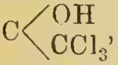
| No. | SUBSTANCE. | HEAT. | HEAT c. NaOH. | $H_2SO_4$ Cold. | $H_2SO_4$ Hot. | $HNO_3$ | N.P.S. & Hal. | M Pt. (°C |
|---|---|---|---|---|---|---|---|---|
| 311 | Tribromphenol Bismuth | Bl. and gives yell. sub first & br. a. | Bl. | Turns grey. | First bl. and then br. | Red-br. c. sl. eff. | Br. | – |
| 312 | Trional ... | M. and evaps. entirely vap. burns c. garlic odor. | Inflam. gas and eff. a lot | Nil. | Br. and ch. | Nil. | S. | 76 |
| 313 | Tropacocaine HCl | M. ch. br. sub. half way up tube. | Wh. vap. | Eff. without ch. | Wh. fumes and ch. | Nil. | N Cl. | — |
| 314 | Tylmarin .. | M. ch. c. characteristic odor vap. burns. | Yell. c. eff. then colorless. | Gr. Yell. | Ch. | Yell. | Nil. | 152 |
| 315 | Urea ... .. | M. gives wh. sub. & alk. vap. Res. goes solid & yell. then sub. entirely. | Strong alk. vap. | Nil. | Brisk eff. no col. | Nil. | N. | 132 |
| 316 | Urethane .. | M. evaps. vap burns. | Alk. vap. burns. | Nil. | Dark br. not ch. | Nil. | N. | 45 |
| 317 | Veratrina ... | M. to yell. br. liq. Br. dist. vap. burns. | Br. & floats on soda. | Yell. to red slow. | Deep red & ch. | Pink to br. | N. | 152 |
| 318 | Veronal... ... | M. & sub. entirely vap. burns. | Alk. vap. & peculiar odor. | Nil. | Ch. lowly. | Nil. | N. | 191 |
| 319 | Zinc Sulpho-Carb. | Ch. c. odor of Phenol. vap. burns. | Liquefies. | Nil. | Ch. slowly. | Br. after a time. | S. | — |

| No. | Sp. Gr. | Sol. Aq. (1 in -). | Sol. Alc. (1 in -) | Litmus. | $Fe_2^{\prime\prime\prime}Cl_6$ b. & a. boil. | Br. Aq. | Fehling's b. & a. boil. | Mayer's. | Gold Chl. | Acid Picric. | Drag |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 311 | — | Insol. | Insol. | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 312 | — | V. sl. | 11 | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil | Nil |
| 313 | — | 2 | About 9 | Neut. | Red tinge | Yell. pp. | Nil. | Wh. pp. | Yell. pp | Yell. pp. | Red br. pp. |
| 314 | — | Sl. | 15 | Sl. ac. | Nil. | Sl. cloud. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 315 | — | 1 | $7\frac{1}{2}$ | Neut. | Nil. | Nil. | Nil b. sl. red pp. a. | Nil. | Nil. | Nil. | Nil |
| 316 | — | 2 | Less than 1. | Neut. | Grey br. pp. b., dark br. pp. a. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 317 | — | V. sl. | 3 | V. faint. alk. | Nil. | Yell. pp. | Nil. | V. sl. wh. pp. | Sl. cloud. | Nil. | Red br. pp. |
| 318 | — | 150 | 9 | Neut. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. | Nil. |
| 319 | — | 2 | $3\frac{1}{2}$ | Sl. ac. | Vi. col. b. br. a. | Decolorised. | Wh. pp. re-diss. b. nil a. | Nil. | Nil. | Nil. | Nil. |

# CORROBORATIVE TESTS.

1. **Acetanilide.**—Heated with Hydrochloric Acid or Potash Solution splits up into Anilin and Acetic Acid. Heated with Chloroform and Potash gives Phenylisocyanide odor.

0·1 Gm. boiled with HCl 2 Cc. then mixed with 3 Cc. of Aqueous Phenol Solution (1 in 20) and 5 Cc. of filtered saturated Chlorinated Lime Solution, acquires brownish red color which changes to deep blue on adding Ammonia (Indophenol test U.S.P.), see also B.P. for further tests.

2. **Acetone.**—Oxidation with Bichromate and Sulphuric Acid gives Acetic and Formic Acids. Combines with Chloroform in presence of Caustic Alkali to form Acetone Chloroform $(CH_3)_2:$  $C<^{OH}_{CCl_3}$, colorless crystals M.Pt. 96°C. insoluble in water. In aqueous solution can be thrown out by Salts, e.g., Calcium Chloride For detection of small quantities, e.g., in urine by Iodoform Test, v p. **141**., and p. 1., Vol. I.

3. **Acetophenone.**—With Hydroxylamin forms Acetoxim $C_6H_5.C(N.OH).CH_3$ Colorless needles M.Pt. 59° C. This by action of Sulphuric Acid or Hydrochloric Acid in Glacial Acetic Acid solution is converted into Acetanilide (Beckmann's reaction). Schmidt, Vol. II., part 1, *p.* 1037.

7. **Acid. Acetyl-*o*-Coumaric,** see "**Tylmarin.**"

8. **Acid. Agaric.**—Turns gelatinous and soapy on boiling with water and gives Pettenköfer's test, *c.f.*, Sodium Taurocholate.

9. **Acid. Cacodylic.**—See also Vol. I., *p.* 162.

11. **Acid. Carbol. Cryst.**—Turns brown with $NaNO_2+HCl$ and reddish brown on adding NaOH.

12. **Acid Cholalic.**—Gives blue unstable compounds with Iodine resembling Starch Iodide.—Watts *q.v.* for further full information

13. **Acid Cinnamic.**—Oxidised with Potassium Permanganate to Benzaldehyde. Can be reduced by Sodium Amalgam to Hydrocinnamic Acid (β.phenyl-propionic Acid).

May be detected in presence of Benzoic Acid by suspending in 5% Uranium Acetate solution and exposing to sunlight,—in a few minutes odor of Benzaldehyde is evolved, and brown precipitate forms.—Allen, vol. II., part **3**, *p.* 40.

15. **Acid Coumaric.**—Melted with KOH gives Salicylate and Acetate. Aqueous solutions of Alkaline Coumarates are fluorescent

16. **Acid Cresylic.**—Goes brownish with $NaNO_2+HCl$, changing to reddish brown with NaOH.

17. **Acid Gallic.**—See B.P., also note,—on adding Lime Water turbidity is produced, becoming grey green and darker.— Hger *Re* Fehling's Solution Test, Allen says reduces slowly and imperfectly. He also states the Tartarated Antimony Test of the B.P. is erroneous.—Vol. II., part **3**, *p.* 119.

Turns deep brown with $NaNO_2$ alone.

19. **Acid Hippuric.**—Boiled with Acids or Caustic Alkalis decomposes into Benzoic Acid and Glycocoll.

20. **Acid Malic.**—Treated with Potash and Bromine Bromoform is formed.—Watts, q.v. *vide* also Schmidt

22. **Acid Nucleinic** —Schmidt II, **2**, *p.* 1797, gives some information on the various Nucleinic Acids (animal, plant, yeast, etc.) but no very distinct analytical reactions. According to this authority Nucleinic Acids boiled with dilute Sulphuric Acid, their decomposition products yield Phosphoric Acid, Carbo-hydrates and Xanthin bases (Xanthin, Guanin, etc.). (Our tests were conducted with slightly brown Nucleinic Acid.)

23. **Acid Oleic.**—Characteristic odor. Solidifies at + 4°C. Pure Oleic Acid as such does not redden Litmus, but does, however, in Alcoholic Solution. Nitrous Acid converts it into the stereoisomeric Elaidic Acid in crystalline leaflets, M.Pt. 45°C—Schmidt also Allen, Vol. II., part **1**, *p.* 261.

24. **Acid Oxalic.**—A neutral alkaline salt Solution gives precipitate with soluble lime salt, insoluble in Acetic Acid, but soluble in HCl. Potassium Permanganate is decolorised in hot solution.

25. **Acid Pyrogallic.**—In presence of Caustic Alkali rapidly darkens. (Takes up Oxygen).

27. **Acid Sclerotic.**—Precipitated by Tannic Acid and Phosphomolybdic Acid.—Schmidt.

30. **Acid Tannic.**—See B.P. Gives precipitate with gelatin, $Pb(NO_3)_2$, $Bi(NO_3)_3$ and Ammoniacal Copper Sulphate.—(Distinctions from Gallic Acid). Is hydrolised into Gallic Acid by boiling with dilute Sulphuric Acid. Gives brown with $NaNO_2$.

34. **Acoine.**—Gives brownish green with $H_2SO_4$ and $K_2Cr_2O_7$; is precipitated both by acids and alkalies (Soluble 1 in 16,—P.J. i./10, 325: we found 1 in 30).

36. **Adrenalin.**—$NaNO_2$ alone gives red color. For Phosphoretted Hydrogen odor with NaOH,—*vide* Vol. I., *p.* 955. Reduces $AgNO_3$ Solution.

37. **Æsculin** —Yields Glucose and Æsculetin on hydrolysis and then reduces Fehling's. Gives blood red color when treated with Nitric Acid and then excess of Ammonia. Gives blue fluorescence in alkaline solution. Treated with Sulphuric Acid and then solution of NaOCl gives violet color.—Allen, Watts.

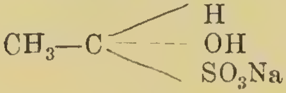
38. **Æthyl Bromidum.**—Differs from the poisonous Ethylene Bromide by Sp. Gr. and boiling point.—*Vide* Vol. I., *p.* 97.

41. **Agurin.**—Gives murexid reaction. Aqueous solution 1 in 5 neutralised with dilute Hydrochloric Acid in presence of Litmus Solution gives white precipitate of Theobromine. (A little alkali assists its solubility in water).

42. **Airol.**—Easily soluble in Mineral Acids and Caustic Alkalies. Gradually turns red in moist atmosphere.

44. **Alcohol Methylic.**—Method of detection.—P.J. ii./05,440; i./07,404.

45. **Aldehyde Absolute.**—Shaken with Concentrated Sodium Bisulphate Solution gives crystalline addition-product



$$CH_3—C\begin{cases}H\\OH\\SO_3Na\end{cases}$$

decomposed by acid or alkali. Combines with Phenylhydrazin forming Ethyliden-phenylhydrazone. Combines with Ammonia forming additive compound. c.f. Schmidt, vol. II., 1, *pp*. 305, 306, or other text books.

47. **Alloxan.**—Aqueous solution slowly turns red when applied to the skin. Solid NaOH turns spirituous solution blue, which is decolorised by water.

51. **Aloin.**—Ammonia changes an alcoholic solution of Barbaloin and Socaloin brown red, and Nataloin carmine red.—Schmidt. q.v. for further distinctive tests. Dieterich states the Aloins evaporated to dryness even in minute quantity with Nitric Acid, (Sp. Gr. 1·4) on water bath, and the residue dissolved in alcohol, the red solution on adding a little Alcoholic KCN solution turns pink.

55. **Alypin.**—Behaves similarly to Cocaine, *c.f.*, p. **30**, Vol. I., *p.* 270. Can be distinguished by fact that 4% solution does not precipitate with Platinic Chloride in presence of HCl. (W.H.M.)

58. **Amyl Nitris.**—Characteristic odor,—produces flushing of face on inhalation,—for further information, *v.* Vol. I., *p.* 129, *et seq.*

61. **Anaesthesin.**—Gives Isonitril reaction *c.f.*, Acetanilide.

62. **Anilin.**—A mixture of Nitric and Sulphuric Acids give fine blue color. To neutral aqueous or slightly alkaline solution add Sodium Hypochlorite or Chlorinated Lime Solution,—purple violet even in 1 in 26,000,—changing to dirty red. Avoid excess of Reagent (Runge). When this change has occurred add dilute Ammoniacal Phenol solution, return of blue color (Jacquemin-Dragendorff) even in 1 in 66,000. Aqueous Chromic Acid Solution according to concentration, gives green, blue, or almost black (Fritzsche). For other tests *vide* Schmidt or special Anilin Color treatises. Diazo test gives red dye.

63. **Anthrarobin.**—Easily soluble in Caustic Alkalis and Ammonia, giving yellowish solution gradually changing to green or blue owing to formation of Alizarin.

65. **Antimonii et Potassii Tartras.**—HCl Solution gives orange red pp. with $H_2S$ soluble in Ammonium Sulphide and KOH. On "Marshing" black mirror insoluble in Sodium Hypochlorite Solution. With Lime Water white pp., soluble, when freshly precipitated, in Acetic Acid and Ammonium Chloride Solution.

72. **Apomorphine HCl.**—Solution in Sodium Hydrate rapidly becomes red and gradually black. Sodium Bicarbonate throws down precipitate which becomes green on standing—for further details *vide* B.P.

Diazo test,—gives red color with $HNO_2$ fading to brown and finally red color with $\beta$. Naphthol Soda.

73. **Arbutin.**—Hydrolysed by dilute Sulphuric Acid into Glucose and Hydroquinone. Diazo Test,—yellow with HCl and $NaNO_2$ turning red with Sodium Hydrate.

74. **Argentamine.**—Sodium Chloride and Albumin—containing solutions do not precipitate. Hydrochloric Acid throws out Silver Chloride. Potassium Chromate throws down Silver Chromate after addition of Nitric Acid. (Schering)—Schmidt.

78. **Argonin.**—The results recorded in the chart were obtained with Argonin—*L*, the soluble preparation. Ammonium Sulphide turns solutions of it black without immediate precipitate.

80. **Aristochin.**—Gives reactions of Quinine, e.g. Thalleioquin test after hydrolysis with HCl. also slightly before.

82. **Arrhenal.**—See also previous Edition, *p.* 152.

83. **Arsacetin.**—See also previous Edition, *p.* 160.

84. **Arsamin and Atoxyl.**—Diazo test gave positive reaction. —Seealso previous Edition, *pp.* 154 and 160.

86. **Asparagin.**—In alkaline solution is lævorotatory; in acid dextro. Copper Hydrate is dissolved on boiling, forming blue solution, depositing on cooling Asparagin-Copper $(C_4H_7N_2O_3)_2Cu$.

88. **Atropine.**—1 mgr. warmed with 2 Cc. of 5% Mercuric Chloride in 50% Alcohol causes deposition of Mercuric Oxide (with some Mercurous)—Gerrard. Dilates the pupil even in 1 in 130,000 dilution. Responds to Vitali's Test, *v.* Vol. I., *p.* 201. **AtropineSulphate.**—Gives Atropine Gold Chloride,—M.Pt.136–138°C.

89 **Benzol.**—See B.P. for the official article. To distinguish from Petroleum Benzin note solubility in Alcohol. Benzol is soluble with half its volume of Alcohol 90%, but Petroleum Benzin requires 5 to 6 times its volume (using 'Petrol' considerably more.—W.H.M) 1 Cc. Petroleum Benzin added to 5 to 10 times the quantity of a mixture of 2 parts Nitric Acid (Commercial) and 1 part Sulphuric

Acid,—warm slightly:—Benzol gives with evolution of red vapors, yellow nitro compounds, then dilute with 10 to 15 times the quantity of water, odor resembling Bitter Almonds, especially on well diluting. Petroleum Benzin on this treatment is hardly affected. For Dragon's Blood Test, *vide* Vol. I., p. 286.

93. **Betaine HCl.**—Gold Salt melts at 221°C.

94. **Betol.**—Alcoholic Solution gives violet color with Ferric Chloride Solution.

96. **Bismuthi Citras.**—Soluble in $NH_3$ and Alkali Citrates. Dissolved in Aqueous Ammonia and evaporated, Bismuth Ammonium Citrate is formed.

98. **Bismuthi Salicylas.**—For estimation of Salicylic Acid, *v.* Vol. I., *p.* **25**.

99. **Borovertin.** — Crystalline precipitate with Hydrochloric Acid and Sodium Nitrite.

100. **Bromalbacid.**—On adding Sodium Nitrite and HCl. odor of Isonitrile.

101. **Bromalhydrate.**—Decomposes at 100–110°C into Bromal and water.

102. **Bromalin.**—Heated with Soda Solution gives odor of Formalin.

104. **Bromocoll.**—Gives a beautiful violet color with dilute Sodium Hydrate.

107. **Butyl Chloral.**—Nitric Acid converts it into Trichlorbutyric Acid, M.Pt.44°C.

108. **Caffeine.**—Heated with Nitric Acid forms Cholestrophan (*v.* Schmidt for further tests).

110. **Caffeine Sodium Salicylate.** — Estimation of Caffeine can be conducted by extracting with boiling Chloroform.

114. **Camphor Monobromide.**—Alcoholic Potash has no action, but Silver Oxide in presence of Chloroform decomposes it. With Hydroxylamin forms Camphor-Oxim $C_{10}H_{16}=N—OH$. M.Pt.118°C —Schmidt. Heated with 4 times its quantity of Nitric Acid on sand bath forms Camphoric Acid and Brom-Nitro-Camphor.—Rhombic prisms almost insoluble in alcohol. M.Pt. 105° C.

115. **Cannabin Tannate.**—Shaken with Sodium Hydrate Solution and Ether, and the Ether Solution evaporated, a slightly alkaline yellowish residue (narcotic) remains.

116. **Cantharidin.**—Schmidt gives solubility in water 1 in 30,000 only. Boiled with Soda and Potash forms Cantharidates. 0·00014 Gm. of Cantharidin will produce a blister.—Schmidt.

119. **Cellotropine.**—Can be hydrolised into Benzoic Acid and Arbutin. The latter ultimately to Hydroquinone and Glucose. Arbutin gives blue with Dilute Ferric Chloride Solution.—Watts.

120. **Chinolin.**—Diazo test gives slight brownish tinge.

Boiling point 236—238°C. A mixture of Sulphuric Acid and fuming Nitric Acid produces crystallised Nitro-Chinolin $C_9H_6N.NO$ . On water bath $H_2SO_4$ produces mainly Cryst. *o*-Chinolin-Sulphonic Acid,—$C_9H_6N.SO_3H$ see also Schmidt, vol. II., 2, *p*. 1342. The amorphous precipitate with Mayer's Reagent can be converted into amber yellow needles, on adding HCl.—Characteristic. Allen, vol. III., 2, *p*. 117.

121. **Chinosol.**—Diazo Test gives slight brownish red.

Mixture of *o*-Oxychinolin Sulphate and Potassium Sulphate. Former can be removed by Alcohol.—Schmidt, vol. II, 2, *p*. 1349.

122. **Chloralamid.**—Water slightly warm decomposes. Caustic alkalis decompose it into Chloroform, Ammonia and Alkali Formate Dilute acids have no action on it.—Schmidt.

123. **Chloral Hydrate.**—Warmed with a little strong NaOH Solution, Chloroform is liberated, *vide* also B.P. for further details.

124. **Chloralose.**—Dilute Acids produce Chloral and Glucose.

126. **Chrysarobin.**—Partially soluble in KOH Solution with red colour.—*Off*. Allen, vol. III., part 1, *p*. 282, gives tests to distinguish Chrysophanic Acid from Chrysarobin. See also Hager, vol. I., *p*. 825.

We found considerably lower M. Pt. then that given by Watts, etc. Commercial samples vary.

128. **Cinchonidine.**—Gives neither Thalleioquin Test nor the $K_8Fe_2Cy_{12}$ Modification (*c.f.* Cinchonine). Soluble in large amount of Ether. Sodium Potassium Tartrate in neutral solution of a salt gives white precipitate, *c.f.*, Allen, vol. III., part 2, *p*. 428.

129. **Cinchonine.**—Only slightly soluble in Ether (1 in 370). There are few characteristic reactions. Not precipitated by $NaHCO_3$ in presence of Tartaric Acid (Quinine and Cinchonidine are). Does not give Thalleioquin Test, nor red color with $K_8Fe_2Cy_{12}$ and Ammonia on addition of these to Acetic Acid Solution after treating with Br. (difference from Quinine and Quinidine). Not rendered fluorescent by very dilute Sulphuric Acid. See also Schmidt, vol. II., 2, *p*. 1565.

130. **Cinnamic Aldehyde.**—B. Pt. 245 to 247°. May be oxidised into Benzaldehyde and Benzoic Acid. See also Allen, vol. II., 3, *p*. 44; Schmidt, vol. II., 1, *p*. 1097.

132. **Citrophen.**—M. Pt. 181° (Hager). Aqueous Solution is at first precipitated with NaOH Solution, then dissolved. Chromic Acid gives violet. Gives red color with Diazo reaction.

134 and 135. **Cocaine and Cocaine Hydrochloride.**—See p. **30**, and Vol. I., *pp*. 296, 298, also B.P. and Schmidt, vol. II part 2, *p*. 1477 *et seq*, and Allen, vol. III., 2, *p*. 273.

The identification of Cocaine and some Cocaine substittues. Cocaine Salts and substitutes will react under certain conditions with Gold Chloride, Platinum Chloride, Chromic Acid and Potassium Permanganate to form precipitates which, when examined under the microscope, are found to possess definite and characteristic crystalline forms. The Alkaloid, isolated in the usual way, is converted into the Hydrochloride and made up to a 2% solution and tested under definite conditions.—Am. Jl. P.h 1911, *p.* 195.

136. **Codeine Hydrochloride.**—Does not reduce Iodic Acid (Morphine does). No blue color with Ferricyanide and Ferric Chloride (Morphine gives)—*c.f.* Allen, vol. III., 2, *p.* 321, and Schmidt, vol. II., *p.* 1510. 0·1 grm. warmed with about 1 Cc. Sulphuric Acid and 1 drop of $Fe_2Cl_6$ solution gives deep blue color. Greenish blue with Fröhde's Reagent.

137. **Colchicine.**—Only slightly soluble in Ether or Benzol. Practically insoluble in Petrol Ether. $H_2SO_4$ with a trace of $HNO_3$ added gives yellowish green changing to blue violet and wine red to yellow. (Dragendorff). Cl water gives yellow precipitate with an aqueous colchicine solution soluble in $NH_3$ with orange color.—*c.f.* Allen, vol. III., 3, *p.* 4. Also Schmidt, vol. II., 2, *p.* 1412. $NaNO^2+HCl$ give dirty brown pp.

140. **Conium Bases.**—See also *p.* **30.**

145. **Cubebin.**—With $K_2Mn_2O_8$ in alkaline solution oxidised to Piperonylic Acid and Oxalic Acid.—Schmidt, vol. II., 2, *p.* 1669.

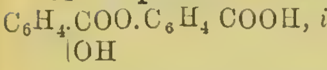
147. **Dermatol.**—NaOH dissolves it with yellow color—turning red.

148. **Dextrose.**—$[\alpha]_D = +\ 104°$ for the pure article in fresh solution. For the Hydrate $[\alpha]_D = +\ 90$ to 96°. Aqueous solutions of silver are reduced especially when warmed. In addition to Fehling's, Barfoed's Reagent (warm) is also reduced (distinction from Dextrin and Maltose). Sodium, Calcium and Barium Oxides form saccharates soluble in water. Ferments with yeast (useful confirmatory test).

149. **Digitoxin.**—HCl Sp. Gr. 1·19 dissolves it in the cold without coloration, but on warming it dissolves with brownish color.—*c.f.* Schmidt, vol. II., 2, *p.* 1640 for other special tests.

150. **Dionine.**—Does not give blue color with Ferric Chloride or reduce Iodates direct. 0·01 Gm. Dionine dissolved in 10 Cc Sulphuric Acid after liberation of the HCl from the compound gives a clear solution which, on adding a drop of Ferric Chloride solution and warming turns violet to deep blue, changing to deep red on adding 2 to 3 drops of Nitric Acid. The free base (Ethyl Morphine) is less soluble in Ammonia than *Codeine*. Such solution reprecipis tates the base in prismatic crystals melting at 93°C. Dionine is distinguished from *Morphine* in that, on adding it to a solution of Potassium Ferri-cyanide with Ferric Chloride, it does not give an immediate blue; but gradually a bluish green color.—Hager.

151. **Diplosal.**—Yields Salicylic Acid on hydrolysis. Formula



$C_6H_4(OH).COO.C_6H_4\,COOH$, *i.e.*, Salicyl-Salicylic Acid.

152. **Diuretin.**—Theobromine-Sodium Salicylate.
On acidifying with Hydrochloric Acid, Salicylic Acid is thrown out which may be identified. Theobromine may be removed from filtrate with Chloroform, this will give the Murexide Reaction.

154. **Duotal.**—Hydrolised gives reactions of Guaiacol.

155. **Dymal.**—Gives reactions for Didymium and Salicylic Acid.

156. **Elaterin.**—With Fröhde's Reagent: first green then brown color. Mandelin's Reagent gives black, see also U.S.

157. **Emetine.**—Sulphomolybdic Acid gives brown color changed to blue by HCl. Chlorinated Lime Test *vide* Allen, vol. II., **3**, *p.* 24, *et seq.*

159. **Ephedrine** base melts at 30°C,—Schmidt. On oxidation yields Benzoic Acid, Oxalic Acid and Methylamine (Merck).

160. **Epicarin.**—Soluble in alkalis with red color. Alcoholic Solution gives with $Fe_2Cl_6$ intense blue. Shaken with KOH and $CHCl_3$ red color changing to brown on heating.—Hager. A drop of Concentrated Sulphuric Acid Solution turns green when exposed to the vapor of $HNO_3$.

A very dilute Solution in Concentrated Sulphuric Acid is green.

161. **Ergotinine.**—Anhydrous $Fe_2Cl_6$ added to a solution in Concentrated $H_2SO_4$ gives yellow color passing through orange, crimson and green to a permanent blue. A dilute Acetic Acid Solution layered on Conc. $H_2SO_4$ gives an upper layer of violet and a lower one of green at junction of liquids.

163. **Eucaine Lactate** and **Eucaine Hydrochloride.**—1 drop of 1% Solution mixed with 1 drop of Mercuric Chloride Solution (1 in 20) gives no precipitate (difference from Cocaine).—P. Helv. This Pharmacopœia also gives an Ammonia precipitation test in several stages, *q.v.* Not colored by Fröhde's Reagent.
Moistened with $HNO_3$ and evaporated to dryness and alcoholic KOH added—Benzoic Ether odor.—Hager.

A 4% solution of the hydrochloride gives slight golden brown pp. with Platinic Chloride dissolving in HCl and throwing out again crystalline after a few minutes.

164. **Eucalyptol.**—1 Cc. placed in a freezing mixture, and equal volume of Phosphoric Acid added gradually: a solid white crystalline mass of Cineol Phosphate results. If warm water be then added Cineol will separate.—U. S.

Agitated with strong solution of Iodine in Potassium Iodide a pasty mass is produced in which green lustrous crystals are formed.—Allen, vol. II., **3**, *p.* 349.

167. **Euresol.**—Gives reactions of Resorcin and Acetic Acid. On cautiously heating 0·05 Gm. with 0·1 Gm. Tartaric Acid and

10 drops of $H_2SO_4$ a carmine red liquid is produced becoming pale yellow on diluting with water (Test for Resorcin.—U.S.). On heating 0·1 Gm. with 1 Cc. 5% KOH Solution and a drop of Chloroform crimson color results, changed to yellow by HCl (Test for Resorcin, U.S.).

169. **Europhen.**—Decomposed by water, Iodine being liberated also decomposed by alkalis.

170. **Exalgin.**—Characters similar to Acetanilide.

171. **Fluorescein.**—Unmistakable fluorescence. Heated with zinc dust and caustic soda reduced to colorless Fluorescin.

Extremely dilute solution shows green by reflected light and yellow by transmitted light. Color discharged by Acid.

172. **Formaldehyde.**—Adds Ammonia. Reduces Ammoniacal Silver Nitrate Solution (Mirror). Responds to Schiff's Reagent. See also Milk Tests, Urine Tests and Paraform, *pp.* **188**, **169**, and Vol. I., *p.* 114.

174. **Fuchsin.**—Is decolorised by Zinc and HCl also by Sulphurous Acid. For detection of minute quantities as in urine, etc., see Schmidt, vol. II., 2, *p.* 1142, also *p.* 1771.

Diazo test destroys color,—dark brown with β. Naphthol.

Guaiacol gives dark reddish brown color with $NaNO_2$ and HCl.

175. **Gelseminine** (Merck).—With $H_2SO_4$ and $K_2Cr_2O_7$ reddish violet then green.

177. **Glycogen.**—Iodine gives Burgundy red (Schmidt) O.R., $[\alpha_D] = +193{\cdot}63$ (Huppert). Amorphous, readily soluble in alkalis q.f.—Allen, vol. I., *p.* 387.

182. **Heroin Base.**—M. Pt. 171°C. $H_2SO_4$ with a little $HNO_3$ gives yellow red, darkening on warming. From Acid Solutions is precipitated by caustic alkalis, Ammonia and Ammon. Carb. redissolved by the first in excess. Does not color Ferric Chloride blue or reduce Iodates (distinction from Morphine).

183. **Heroin HCl.**—Gives reactions of the base. Neither Schmidt nor Hager describe a Diacetyl Morphine Hydrochloride.

184. **Hetraline.**—Brownish pp. with $NaNO_2$ and HCl.

185. **Hexamethylene Tetramine.**—Boiled with dilute acids decomposes into Formaldehyde and $NH_3$.

186. **Holocain HCl.**—Yellow waxy pp. with $NaNO_2$ and HCl.

187. **Homatropine (HBr).**—Dilatation of pupil which passes off rapidly in comparison with that produced by Atropine. Does not react to Vitali's test (Ac. Nitric Fuming, and Alcoholic KOH—*v.* Vol. I., *p.* 201)—gives yellow instead of violet given by Atropine. Does not precipitate with Tannic Acid nor Platinic Chloride after previous addition of Hydrochloric Acid.

188· **Hydrastine.**—Fröhde's Reagent green to brown color. Vanadin Sulphuric Acid red to orange red. To distinguish from Hydrastinine, *vide* Vol. I., *p.* 435.

189. **Hydrastinine.**—The Sulphate dissolves with fluorescence. Schmidt goes very fully into the alkaloid.

190. **Hydrargyri Succinas.**—Easily Soluble in $HNO_3$ on bringing together a fairly dilute solution of Alkali Succinate and the Mercury salt.

193. **Hyoscine HBr.** — Response to Vitali's reaction very similar to that with Hyoscyamine and Atropine.

194.—**Hyoscyamine Sulph.**—Reaction with Vitali's Test (Fuming Nitric Acid and Alcoholic KOH.) similar to that with Atropine. *v.* Vol. 1., *p.* 201.

Gold Salt (recrystallised from hot water) is in golden shining leaflets, M.Pt. 160–163°C. Solutions reduce in the light.

Does not precipitate with Platinic Chloride Solution.—Difference from most Alkaloids—U.S.

195. **Hypnal.**—Gives green pp. with $NaNO_2$ and HCl.

199. **Indigo.**—Purple vapors on heating in test tube. Color disappears on acting on it with Alkaline Reducing Agents, e.g., NaOH and Zinc, see also Schmidt, vol. II. 2, *p.* 1112 *et seq*

200. **Indigo-Carmine.**—Diazo test gives green color.

202. **Iodol.**—Warmed with NaOH and Zinc filings, fumes of Pyrrol are given off. These color pine wood, e.g., a match soaked in HCl bright red. Gives bright red on warming an alcoholic solution with Nitric Acid (Allen).

203. **Iohydrin.**—$NaNO_2$ and HCl liberate Iodine.

206. **Lactophenin.**—Reacts similarly to Phenacetin with B.P. Chromic Acid Test.

207. **Lævulose.**—Reduces Bismuth Salts in alkaline solution) On warming with KOH or NaOH turns brown (as also Glucose. Fermentable direct, but more slowly than glucose. Lævorotatory

209. **Lecithin.**—Boiled with Baryta gives Glycerophosphoric Acid, Neurine and a fatty acid (Stearic, Oleic or Palmitic).—Watts.

213. **Mannitol Nit.**—Explodes at 120°C.—Hager.

215. **Methylene Blue.**—Nitrous Acid converts it into Methylene green.

216. **Migrainine.**—Gives reactions of Antipyrin, and Caffeine. The Citric Acid present is not easily detected—Solutions give no pp. with $CaCl_2$.

The Antipyrin may be precipitated with Potassio-Mercuric Iodide (Caffeine is not precipitated). The presence of Antipyrin does not interfere with the Caffeine yielding the murexid reaction provided all the Antipyrine precipitated with Br. Water is filtered out first.

If to a strong solution of Migrainine Ferric Chloride Solution be added in excess, then HCl, the red color is destroyed and a yellow pp. formed. Phenazone also gives this reaction.

Migrainine gives green color and pp. with $NaNO_2$ and HCl.

217. **Morphine HCl.**—Reddish Violet quickly changing to Slatey Blue with Fröhde's Reagent. Liberates Iodine from Iodic Acid. Gives blue pp. with $Fe_2Cl_6$ and $K_6Fe_2(CN)_{12}$. Solution (freshly prepared).

218. **Mydriasine.**—Gives Vitali's Reaction, *c.f.* Atropine.

221. **Nicotine.**—Dropped on paper causes a grease spot which disappears after a time. Phosphomolybdic Acid gives yellowish pp. For formation of Periodide (Roussin's crystals), see Hager, vol. II, *p.* 481.

223. **Nitrobenzene.**—Detection of traces: Distil with a little Sulphuric Acid in steam, shake distillate with Chloroform, convert. Oily drops into anilin by reduction with Zinc and Sulphuric Acid.

225. **Novocain.**—Diazo test gives red dye.—Note also distinctive colors in chart.

226. **Nuclein.**—c.f. Acid Nucleinic.

227. **Orexin Tannate.**—Gives Carbylamine reaction on heating with NaOH and $CHCl_3$. Turns resinous with dilute HCl. in the cold, but dissolves on heating.

229. **Orthoform.**—Distinguished from Cocaine, Eucaine, Stovaine, Holocaine, Novocaine, Alypin and Tropococaine by Fröhde's Reagent, which gives a faint violet tinge, but nothing with the others except Tropococaine which gives slight green.

Does not give Diazo Reaction, but turns yellow with $NaNO_2$ and HCl.

230. **Paraform.**—Characteristic odor of Formalin on heating. Distillate (Formalin collected in water) reduces Silver Nitrate (forming mirror). Responds to Schiff's Test (Sulphurous Fuchsin Solution). Sodium Nitroprusside 0·5% gives reddish color which on acidifying with Acetic Acid is changed to purple.

Nessler's Reagent gives a reddish precipitate which gradually changes to gray.—Schmidt.

If to 5 Cc Sulphuric Acid in which a little Salicylic Acid has been dissolved, 2 drops of Formalin Solution (37%) be added and the liquid very gently warmed, a permanent deep red color develops (U.S.).

In general the distillate gives reactions of Aldehydes.

231. **Paraldehyde**—is more soluble in cold water than hot,—saturated aqueous solution becomes turbid on warming. Gives mirror with Ammoniacal Silver Nitrate Solution on warming (U.S.). Gives in general reactions of Aldehydes, but does not add Ammonia nor Sodium Bisulphite.

232. **Pelletierine.**—Process of extraction and characters of constituents.—Schmidt, vol., II., 2, *p.* 1582, *et seq.*

233. **Petrol Ether.**—Does not dissolve Dragon's Blood (distinction from Benzene).

234. **Phenacetin.**—Potassium Dichromate in HCl Solution gives deep red colour,—see B. P. 1 Cc of a solution of 0·2 Gm. Phenacetin in 2 Cc HCl, (25%) boiled, cooled and filtered gives reddish violet on adding 5 drops of fresh Cl water.

235. **Phenalgin.**—Alcoholic extractive evaporated to dryness gives reactions of Acetanilide.

236. **Phenazone.**—Gives green pp. with $HNO_2$.

Aqueous Solution gives with equal volume Nitric Acid yellow solution changing to crimson (*Off.*) on warming. Tannin solution gives a white precipitate with a 1% solution.

237. **Phenocoll HCl.**—On treating 1 Cc of solution of 0·2 Gm. in 2 Cc of HCl (25%) boiled, cooled and filtered with 5 drops of fresh Cl water gives reddish violet color. 0·1 Gm. boiled with 2 Cc 33% NaOH and then 2 drops of $CHCl_3$ added gives powerful Isonitrile odor and black oily drops float on surface.

239. **Phenolphthalein.**—Red color with caustic alkalis disappearing with Acids. Silver Nitrate gives violet pp.

240. **Phloridzin.**—Solutions have great avidity for Ammonia. In taking up 10% it turns to red and melts at the same time to a colorless mass. For details *re* Phloridzin-Ammonia see Schmidt, Vol. II., 2, *p.* 1715.

Mix 0·1 grm. with a crystal of Vanillin and 1 drop of HCl conc. and warm,—a fine red colour will result.

241. **Physostigmine.**—Calx Chlorinata turns a solution intensely red, but on further addition completely decolorises,—see also Schmidt for a number of other color reactions.

Brown color with $NaNO_2$ and HCl turning blue with NaOH.

242. **Physostigmine Sulph.**—Brown color with $NaNO_2$ and HCl, violet pp. with NaOH.

243. **Phytin.**—Solution throws down a pp. on heating. This is prevented by mineral acids, but not by Acetic.

Gives Reactions of Calcium and Mg. (Al. ?.)

244. **Picrotoxin.**—Mixed with 3 times its weight of $KNO_3$ and then moistened with $H_2SO_4$ and then NaOH in excess added gives intense red color.—Langley's Reaction.

To a trace on a watch glass add 1 drop 20% Benzaldehyde in absolute Alcohol and then 1 drop $H_2SO_4$ without shaking,—violet color (Melzer),—see also Schmidt.

245. **Pilocarpine.**—To a solution in Conc. $H_2SO_4$ add a trace of Potassium Bichromate,—bluish green immediately changing to fairly permanent green.

Phosphomolybdic Acid, Phospho-Tungstic Acid and Iodo-Potassic, Iodide pp. from HCl solution.

246. **Pilocarpine Nitrate as Pilocarpine.**

247. **Piperazin.**—Dissolves Uric Acid forming the neutral urate. Piperazin Phosphate forms 4-sided tabular crystals, which character

and those of the Bismutho-iodide distinguish it from Spermine $C_{10}H_{26}O_4$ which it closely resembles.— Allen, vol. III., part 2, *p.* 105.

Gives white pp. with Nessler's Reagent.

Forms crystaline pp. with $NaNO_2$ and HCl.

248. **Piperazin Benzoate.** — Aqueous solution acidified with HCl throws out Benzoic Acid. The Aqueous Solution gives test for Piperazin *q.v.*

250. **Podophyllin.**—Podophyllotoxin constituent of, M.Pt. 117°C.

252. **Proponal.**—White pp. with Millon's Reagent redissolving in excess of Reagent.

253. **Protargol.**—Ammonium Sulphide colours solution blackish brown without causing pp. To 2 Cc. of Protargol Solution (1 in 20) add 1 drop of 30% Acetic Acid, white caseous pp., soluble in excess. (Based on Schmidt.)

Residue on incineration gives reactions for Silver. Picric Acid precipitates.—See also foreign pharmacopœias.

254. **Pyramidon.**—Gives violet colour with $NaNO_2$ and HCl.

257. **Quinine Sulphate.**—Dissolves with blue fluorescence in $H_2SO_4$, Acetic Acid and Tartaric Acid. For substances interfering see Hager, *p.* 745.

Gives white pp. with $NH_3$ soluble in Ether and in excess of $NH_3$. Thalleioquin Test with Cl and $NH_3$. See also Vol. I., p. 649 and B.P.

258. **Resorcin.**—On cautiously heating 0·05 Gm. with 0·1 Gm. Tartaric Acid and 10 drops Conc. $H_2SO_4$ thick carmine red liquid produced which becomes yellow on diluting with water. Ammoniacal $AgNO_3$ solution is reduced forming Mirror (*s.a.*)

Not precipitated by neutral Lead Acetate (distinction from Pyrocatechin),—see also Hager II., *p.* 724 for several further tests.

Gives brown pp. with $NaNO_2$ and HCl.

Blue with $Fe_2Cl_6$ changing to brownish yellow on adding $NH_3$: distinction from Catechol and Quinol.—U.S.

259. **Sabromin.**—Ash gives reaction for Calcium.

260. **Saccharin.**—Dissolved in 25% KOH *q.s.* and Br. water added till yellow coloration, Br. substitution body is gradually thrown out. Heated with Resorcin and $H_2SO_4$ yellowish red then dark green color. After cooling dissolve the mass in water and add NaOH in excess,—intense green fluorescence (Bonstein says 0·0019 Gm. will give this).—Schmidt. See also B.P. and U.S.

261. **Sajodin.**—Gives reactions of Calcium in the Ash.

262. **Salacetol.**—Gives on alkaline hydrolysis reactions of Salicylic Acid and the hydrolised liquid reduces Fehling's Solution, smells of Methyl Salicylate and burnt sugar and turns dark yellow.

263. **Salicin.**—Heated with Potassium Dichromate, a few drops of Sulphuric Acid and some water gives Salicylic Aldehyde (odor of

Meadow Sweet).—*Off* Dissolves in Hydrochloric Acid which on boiling throws out resin (Saliretin) see Allen, vol. III., part 3, *p.* 99, for more.

264. **Salipyrin.**—Green color c. $NaNO_2$ and HCl.

265. **Sal Limonis.**—Calcium Chloride gives white pp., insoluble in Acetic Acid. Potash flame. Decolorises $K_2Mn_2O$, with effervescence on warming at 60-65° with Ac. Sulph. dil.

267. **Salol.**—Alcoholic Solution precipitates with Bromine. Violet with Ferric Chloride in alcoholic solution. Test for Phenol and Salicylic Acid after melting with Soda. (*Off.*).

268. **Salophen.**—Yields Salicylic Acid on hydrolysis c. NaOH. Is not hydrolised by HCl. Does not give Isonitrile test, but on adding the chloroform it gives a brownish red color.

When hydrolysing with dilute NaOH it turns blue, the color changing to reddish violet on boiling, the blue reappearing on cooling is changed to red with HCl.

269. **Saloquinine.**—On hydrolysis gives reactions of Quinine and Salicylic Acid.

271. **Santonin.**—See B.P. and U.S.

272. **Santyl.**—Alcoholic solution colored violet by $FeCl_3$ solution.

274. **Sodium Glycerophosphate.**—On incineration Pyrophosphate is formed.

Lead Acetate precipitates but not Magnesia mixture. Cold Ammonium Molybdate, either precipitates on standing or heating.—(Schmidt.)

275. **Sodium p-aminophenylarsonate.** — See also *p.* **20**, and previous Edition for further analytical information.

278. **Sodium Sulphocarbolate.**—Dilute solution does not give yellowish brown with Uranium Nitrate solution (distinction from Salicylate), Soda flame.

280. **Sodium Taurocholate**—Taurocholic Acid forms shining hygroscopic bitter needles easily soluble in water and alcohol. Solutions dextrorotatory. On heating with water at 100° C. or boiling with KOH or acids, decomposes into Cholic Acid $C_{24}H_{40}O_5$ and Taurin $C_2H_7NO_3S$.—Watts and Schmidt.

To Aqueous Solution of the Sodium Salt add $\frac{2}{3}$ bulk of Sulphuric Acid and a few drops of Syrup. Intense violet color develops.—Pettinköfer's Bile Acid Test.—Allen, vol. III., part 3, *p.* 401.

The Acid precipitates Albumins and Globulins from solution but not Peptones.—Allen, vol. III., part 3, *p.* 397.

281. **Sozoidol (Soda).**—Gives orange pp. with $NaNO_2$ alone, turning darker with HCl.—See Hager, *p.* 111.

282. **Sparteine Sulphate.**—For further tests *vide* U.S., and Allen, vol. III., part 2, *p.* 198. Ammonium Sulphydrate forms permanent orange red color.

284. **Strophanthin.**—Re the $FeCl_3$ test—add a trace of $FeCl_3$ to an aqueous solution, then Concentrated Sulphuric Acid to obtain brownish pp. which changes in two hours to dark green.—Schmidt.

Solution dextrorotatory.—(U.S.)

285. **Strychnine.**—Gives Vitali's Reaction *v.* Vol. I., *p.* 201. Violet with $K_2Cr_2O_7$ and $H_2SO_4$, see also Allen, vol. III., part 2, *p.* 364, for several special reactions.

Mandelin's Reagent gives blue color changing to vermilion. On adding alkali a permanent pink to purple color results.

Phospho-molybdic Acid will show 0·0001 Gm., Picric Acid 0·00005 Gm., Tannic Acid 0·00004 Gm., Mercuric Potassium Iodide 0·000006 Gm., Potassium Bismuth Iodide 0·00002 Gm., Platinic Chloride only 0·001 Gm., and Gold Chloride 0·0001 Gm.—Dragendorff.

286. **Stypticin.**—Hager says 0·3 Gm. dissolved in 4 to 5 Cc. water and Iodo-Potassic Iodide added, brown pp. formed which recrystallised from Alcohol melts sharply at 142°C.

287. **Styptol.**—Can be split up into Cotarnine and Phthalic Acid (q.v.—Schmidt).

288. **Styracol.**—Gives reactions of Guaiacol and Cinnamic Acid on hydrolysing.

289. **Sucrose.**—Conc. KOH turns this brown on *heating.* (Glucose is turned brown in the *cold.*) It is not directly fermentable—requires inversion first by yeast or dilute acids into glucose and laevulose. See also B.P. and U.S.

290. **Sulphonal.**—See B.P. and U.S.

291. **Tannalbin.**—The Tannic Acid can be extracted by washing with water and alcohol. Nitrogen content 8%.—Schmidt, vol. II., 1, *p.* 1094 gives test for estimating its capabilities of withstanding Pepsin and Hydrochloric Acid.

294. **Terpineol.**—B.Pt. 218-219°.—See Schmidt, vol. II., 2, *p.* 1187.

295. **Terpin Hydrate**—Conc. HI converts into $C_{10}H_{16}2HI$, see also U.S., Allen, vol. II., 3, *p.* 348, and Schmidt, vol. II., 2, *p.* 1186.

296. **Tetronal** gives reactions similar to Sulphonal (Sulphonmethanum) *q.v.*

297. **Theobromine** gives Murexid Test. Precipitates Silver Theobromine on adding $AgNO_3$ Solution to very dilute Solution of Theobromine Nitrate. Sodium phospho-tungstate gives yellow pp.

Treated with dilute $H_2SO_4$ and Lead Dioxide $CO_2$ is evolved. Product precipitates Sulphur from $H_2S$, colors skin purple red and turns blue with moderate amount of Magnesia.—Allen, vol. III., 2, *p.* 494.

300. **Theophylline.**—Gives Murexid Reaction.

301. **Theophylline Sodium Acetate.**—Gives reactions of Theophylline and also of Acetate (after removing the Theophyllin by neutralising and filtering).

303. **Thigenol.**—Brown pp. with $NaNO_2$ and HCl.

306. **Thiosinamin.**—For conversion into Allyl Cyanamide see Schmidt, vol. II., **1**, *p.* 772.

$NaNO_2$ and HCl pp. yellow oil with mustard odor.

308. **Tiodine.**—Contains Thiosinamin *q.v.*

$NaNO_2$ and HCl gives brown pp. turning yellow with Naphthol.

Yellow pp. with Pb. Acet., insoluble in dilute $HNO_3$, but blackened by conc. $HNO_3$.

309. **Toluol.**—Sp. Gr. 0·872 at 15°C. Yields Benzoic Acid on oxidation.

311. **Tribromphenol Bismuth.**—Gives Bismuth Reactions using an acidulated extractive.

312. **Trional.**—See U.S. (Sulphon-Ethyl-Methanum) tests under.

313. **Tropacocaine HCl.**—Boiled with HCl converted into Benzoic Acid and pseudo-tropine.

314. **Tylmarin.**—Soluble in Chloroform 1 in 14 (distinction from Acid Coumaric, which is only very slightly soluble).

315. **Urea.**—Gives Biuret Reaction. Decomposes with Hypobromite (*vide pp.* **44**, **149**, **180**), *vide* also Allen, vol. III., **3**, *p.* 248.

316. **Urethane.**—M. pt. 50°,—Allen *q.v.* vol. III., **3**, *p.* 248 (we find considerably more soluble than published statement).

317. **Veratrine.**—Gives Vitali's Reaction, *c.f.*, Vol. I., *p.* 201.

318. **Veronal.**—A saturated solution acidified with Nitric Acid gives a white precipitate with Millon's Reagent, soluble in excess.

This test is important from a forensic point of view. A method of extraction and recognition in urine is given in Archiv. d. Pharmacie, 1904, **242**, 6.

319. **Zinc Sulphocarbolate.**—Yellowish green pp. with Pot. Ferro-cyanide insoluble in HCl (method of distinction of Zinc from Aluminium in analysis).

## Approximate Melting Points and Consistence (*Atmospheric Temperature, 11° C.*) of some Fats and Waxes suitable for Suppositories, Pastes, Creams and Ointments.

| | | | |
|---|---|---|---|
| Oleum Theobromatis | 31-32°C. | 87·8-89·6°F. | Yellowish white, hard, brittle, and melts with ease. |
| Sevum Præparatum<br>Oleum Theobromatis } partes æq. | 39 | 102·2 | Rather hard and brittle, but melts with ease. |
| Paraffinum Molle<br>Oleum Theobromatis } partes æq. | 33-34 | 91·4-93·2 | Stiff paste. Easily softened with the fingers. Suitable for thick creams. |
| Paraffinum Molle | 35-39 | 95-102·2 | |
| Unguentum Cetacei | 36 | 96·8 | White, soft base. |
| Adeps | 38 | 100·4 | Soft, white, unctuous. |
| Japan Wax | 50 | 122 | Hard, tough, and tenacious, tallowy. Obtained from *Rhus* species. |
| Adeps Lanæ | 40-44 | 104-111·2 | Yellowish, stiff, tenacious, unctuous. |
| Oleum Theobromatis<br>Cetaceum } partes æq. | 39-40 | 102·2-104 | Hard. Melts easily between the fingers. Not so brittle as Oleum Theobromatis. |
| Sevum Præparatum | 47 | 116·6 | Soft and unctuous. |
| Cetaceum | 46-50 | 114·8-122 | Crystalline, scaly and slippery. |
| Unguentum Paraffini | 47 | 116·6 | Stiff unguent. |
| Ceresin<br>Stearin } partes æq. | 52 | 125·6 | Very hard white mass. |
| Cera Alba 1, Oleum Theobromatis 6 | 51-52 | 123·8-125·6 | Hard glossy mass. Easily melts between the fingers. |
| Japan Wax, Hard Paraffin, equal parts | 48-51 | 118·4-123·8 | Hard, white and brittle. |
| Ceresin | 52-53 | 125·6-127·4 | Hard, like good paraffin. |
| Stearin | 53-54 | 127·4-129·2 | White, hard, crumbling substance. |
| Paraffinum Durum | 54-57 | 129·2-134·6 | Crystalline, hard and unctuous (slightly greasy). |
| Unguentum Resinæ | 54 | 129·2 | |
| Adeps 3 with Cera Alba 1 | 59 | 138·2 | Stiff white pomade. |
| Adeps. Cera Alba, equal parts | 58 | 136·4 | Very hard, white mass. |
| Cetaceum, Cera Alba equal parts | 58-59 | 136·4-138·2 | Hard as last, but not so white in appearance. |
| Cera Alba | 62-64 | 143·6-147.2 | White, hard, tenacious. |
| Carnauba Wax | 85 | 185 | Hard, yellowish, from leaf buds of *Copernicus cerifera*. |
| Carnauba Wax 1, Oleum Amygdalæ 4 | 77-78 | 170·6-172·4 | Stiff mass, melting easily. |
| Carnauba Wax 1, Oleum Amygdalæ 3 | 78-79 | 172·4-174·2 | Stiff ointment of brownish colour. |
| Cera Alba, Oleum Amygdalæ, equal parts | 60-61 | 140-141·8 | Hard and wax-like. |
| Cera Alba 1, Oleum Amygdalæ 5 | 54 | 129·2 | Stiff ointment. |
| Cera Alba 1, Oleum Amygdalæ 9 | 52-53 | 125·6-127·4 | Stiff ointment base. |
| Cera Alba 1, Oleum Amygdalæ 19 | 48-49 | 118·4-120·2 | Very soft creams. |
| Cera Alba 1, Oleum Amygdalæ 39 | 43 | 109·4 | |

# FREEZING MIXTURES.

## For cooling and setting suppositories, bougies, &c.

The following is a list of some freezing mixtures best prepared from commercial Crystalline Salts, and in a thick wooden vessel:—

| | Temp. F. reached. |
|---|---|
| Ammonium Nitrate 1, Water 1 | + 1·4 |
| Sodium Nitrate 3, Dilute Nitric Acid 2 | — 3 |
| Ice 2, Sodium Chloride 1 | — 5 |
| Ammonium Nitrate 1, Sodium Carbonate 1, Water 1 | — 7 |
| Ice 24, Sodium Chloride 5, Ammonium Nitrate 5 | — 18 |
| Ice 3, Sulphuric Acid 2 | — 23 |
| Ice 8, Hydrochloric Acid 5 | — 27 |
| Ice 3, Dilute Nitric Acid 2 | — 46 |
| Sodium Phosphate 3, Ammonium Nitrate 2, Dilute Mixed Acids 4 | — 50 |
| Ice 8, Dilute Sulphuric Acid 10 | — 91 |

# DROP MEASURE TABLE.

Showing the number of drops per gramme from various medicaments delivered (at 15°C.) by a standard pipette 3 mm. in external diameter (*see* 'Weights and Measures,'). Adapted from F.E.

| | No. of drops in 1 Gm. |
|---|---|
| Acetum Opii Compositum | 54 |
| Acidum Hydrochloricum (1·171) | 21 |
| ,, Hydrocyanicum Dilutum (2%) | 22 |
| ,, Nitricum, Sp. Gr. 1·321 | 25 |
| ,, Phosphoricum, Sp. Gr. 1·35 (50% $H_3PO_4$) | 19 |
| ,, Sulphuricum, Sp. Gr. 1·843 | 26 |
| ,, Sulphuricum Alcoholisatum (Aqua Rabeliana) (Sulphuric Acid 1, Alcohol 3 (cautiously mixed) | 55 |
| ,, Sulphuricum Dilutum 10% | 21 |
| Æther | 91 |
| ,, Aceticus, Sp. Gr. 0·915 | 60 |
| ,, Sulphuricus Alcoholisatus (Hoffman's Anodyne) (Ether 4 and Alcohol 1, mixed) | 73 |
| Aqua Distillata | 20 |
| Chloroformum, Sp. Gr. 1·48 | 60 |
| Creosotum, Sp. Gr. 1·08 | 42 |
| Liquor Ammoniæ, Sp. Gr. 0·923 | 24 |
| Oleum Crotonis Tiglii (Aceite de Crotan Tiglio) | 44 |
| ,, Menthæ Piperitæ, Sp. Gr. 0·89 to 0·92 | 52 |
| ,, Terebinthinæ | 56 |
| Solutum Chloruri Ferrici, Sp. Gr. 1·26 (Liquor Ferri Perchloridi) | 18 |
| Tinctura Alcoholica Aconiti (1 of Root in 10) | 58 |
| ,, ,, Belladonnæ, 1 in 10 | 59 |
| ,, ,, Cantharidis, 1 in 10 (with Cochineal 1·5 in 100) | 58 |
| ,, ,, Castorei, 1 in 20 | 57 |
| ,, ,, Colchici, 1 in 10 | 59 |
| ,, ,, Corticis Aurantii (Naranja) Composita (Tinctura Roborans ex Whytt) | 63 |
| ,, ,, Digitalis, 1 in 10 | 58 |
| ,, ,, Fabæ Sancti (Haba de San Ignacio) (Ignatii Composita) Guttæ Amaræ ex Baumé 1 in 2 | 58 |
| ,, ,, Hamamelidis (bark and leaves of each 1 in 20) | 58 |
| ,, ,, Hydrastis, 1 in 10 | 58 |
| ,, ,, Iodi (1 in 10, Alcohol 95%) (Solucion Alcohólica de Yodo) | 62 |
| ,, ,, Lobeliæ, 1 in 10 | 58 |
| ,, ,, Moschi (Almizcle) 1 in 25 | 55 |
| ,, ,, Nucis Vomicæ, 1 in 10, 0·25% Alkaloids approximately | 57 |
| ,, ,, Opii (Extract 1 in 20) | 58 |
| ,, ,, Scillæ (escila) 1 in 5 | 58 |
| ,, ,, Strophanthi (Estrofanto) 1 in 10 | 58 |
| ,, ,, Viburni, 1 in 10 | 58 |
| (All the above tinctures are made with Alcohol 70%.) | |
| Opii Compositum (Laudanum ex Sydenham) | 40 |

# GLOSSARIES

## OF WORDS AND PHRASES LIKELY TO OCCUR AS DIRECTIONS IN FOREIGN PRESCRIPTIONS.

## DANISH GLOSSARY.

*Aandedrag*, breathing.
*Aare*, vein.
*Aare-Indsprõjtning*, intravenous injection.
*Atomsprøjte*, spray or atomiser.
*Badevand*, lotion (lit. bath water).
*Badning*, fomentation.
*Blære*, blister.
*Blandes*, to be mixed.
*Belægges* (*Piller*), to be coated (pills).
*Börstes*, to be brushed.
*Brækmiddel*, emetic.
*Citronsaft*, lemon juice.
*Daglig*, daily.
*Den smærtefulde Del*, the painful part.
*Dessertskefuld*, dessertspoonful.
*Draaber*, drops.
*Døgnet*, the space of 24 hours.
*Efter Maaltid*, after meals
*Etiket med Anvisning*, label with formula.
*Flaske*, bottle.
*Forkølelse*, cold.
*Forsølves* (*Piller*) to be coated (pills).
*Fortyndes*, to be diluted.
*For udvortes Brug*, for external use
*Før Maaltid*, before meals.
*Gift*, poison.
*Glas Kapsler eller smaa Flasker* glass capsules or ampoules.
*Glasstang*, glass rod.
*Gnidnig*, friction.
*Gummerne*, the gums.
*Gurglevand*, gargle.
*Haarvand*, hair-lotion.
*Hjærte*, heart.
*Hostemixtur*, cough-mixture.
*Hovedpine*, head-ache.
*Hud-Indsprøjtning*, subcutaneous
*Hver anden*, every two.
*Hver tredje*, every three.
*Igle*, leech.
*Ikke*, not.
*I lige* **Dele**, of each equal parts.
*Indaanding-indaader*, inhalation-inhaler.
*Indgnid*, rub.
*Indgnides*, to be rubbed.
*Indgydes*, to be instilled.
*Indsprøjtes*, to be injected.
*Indsprøjtning*, injection.
*I Vægt*, by weight.
*Klystér*, enema.
*Knuses eller brækkes*, to be crushed or broken.
*Kop*, cup.
*Krukke*, pot.
*Latverge*, electuary.
*Lige Dele*, equal parts.
*Ligtorn*, corn.
*Mælk*, milk.
*Mellem*, between.
*Moderkrans*, pessary.
*Mundvand*, mouth-wash.
*Muskel-Indsprøjtning*, intramuscular injection.
*Nat*, night.
*Næse*, nose.
*Næsebor*, nostrils.
*Omrystes*, shake (the bottle).
*Omslag*, poultice.
*Opblæsning*, flatulence.
*Opløse*, dissolve.
*Opsnuses gennem Næseborene*, to be sniffed up the nostrils.
*Pensle*, paint (lit. pencil).
*Pensles*, to be painted.
*Rystes*, shake (the bottle).
*Signatur*, label (medical label).
*Skefuld*, spoonful.
*Smærte*, pain.
*Som foreskrevet*, as directed.
*Spiseskefuld*, tablespoonful.
*Sprøjte*, syringe.
*Stikpille*, suppository
*Straks*, at once.
*Tages*, to be taken.
*Tandmiddel*, dentifrice.
*Teskefuld*, teaspoonful.
*To Gange*, twice.
*Tre Gange*, three times
*Ved Sengetid*, just before retiring to rest (lit. at bed-time).
*Vekselvis*, alternately.
*Vægt*, weight.
*Øjendraaber*, eye-drops.
*Øjelaag*, eye-lids.
*Øjenhaar*, eye-lashes.
*Øjenskaerm*, eye-shade.
*Øjenvand* eye-wash.
*Ørepine*, ear-ache.

## DUTCH GLOSSARY.

*Ademhaling*, breathing.
*Ader*, vein.
*Bedekken (pillen)*, to be coated (pills).
*Besproeiingstoestel*, atomiser or spray.
*Bestrijken*, to be painted.
*Blaar*, blister.
*Baarmoederkrans*, pessary.
*Braking*, vomiting.
*Citroensap*, lemon juice.
*Dagelijks*, daily.
*De flesch*, bottle.
*Dicht bij*, near to.
*Den volgenden morgen*, the next, or following morning.
*Droppels* or *druppels*, drops.
*Etiket met recept*, label with formula.
*Gebruik*, use, application.
*Gedurende het bruisen*, during effervescence.
*Gegruisd of in stukjes gebroken*, to be crushed or broken.
*Gelijke deelen*, equal parts.
*Glazen capsules*, glass capsules or ampoules.
*Glazen staafje*, glass rod.
*Goedschudden*, to be well shaken (the bottle).
*Gorgelen*, gargle.
*Het pijnlijk deel*, the painful part.
*Het tandvleesch*, the gums.
*Hoest, de*, the cough.
*Inademing-respirateur*, Inhalation-inhaler.
*Indien het hoesten lastig is*, when the cough is troublesome.
*Indruppelen*, to be instilled.
*Inspuiting binnen de spieren*, intramuscular injection.
*Inspuiting binnen de aderen*, intravenous injection.
*Inspuiting onder de huid*, subcutaneous injection.
*Klisteerspuit*, enema.
*Kokend*, boiling.
*Kopje*, cup.
*Melk*, milk.
*Met mate*, moderately.
*Mondspoeling*, mouth-wash.
*Na den maaltijd*, after meals.
*Neerliggende (rustende)*, lying down.
*Niet te gebruiken*, not to be taken.
*Om de beurt*, alternately.
*Om op te snuiven*, to be sniffed up the nostrils.
*Onmiddellijk*, immediately
*Ooghaartjes*, eye-lashes.
*Oogkapje*, eye-shade.
*Oogleden* eye-lids.
*Oogwassching*, eye-wash.
*Ook*, also.
*Op de gebruikelijke wijze*, in the usual manner (as taken before).
*Papmiddel*, fomentation.
*Per gewicht*, by weight.
*Plaatselijk aan te wenden*, for local use only.
*Potje*, pot.
*Prikkelend*, irritable.
*Purgeerend stroopje*, electuary.
*Spoeling voor de oogen*, eye-wash.
*Steekpilletje*, suppository.
*Sproeier*, spray.
*Spuit*, syringe.
*Stopsel van pluksel*, tampon.
*Tabletje*, tablet.
*Tandpoeder*, dentifrice.
*Van elk evenveel*, of each equal parts.
*Verdeeld in gelijke deelen*, let it be divided into equal parts.
*Vergift*, poison.
*Verzilveren (pillen)*, to be silvered (pills).
*Volgens het voorschrift*, as directed.
*Voor het naar bed gaan*, just before retiring to rest.
*Voor inspuiting*, to be injected.
*Voor inwendig gebruik*, for internal use.
*Voor uitwendig gebruik*, for external use.
*Waskaars*, bougie.
*Winderigheid*, flatulence.
*Wrijven*, rub.
*Wrijving*, friction.
*Zonder*, without.
*Zoo noodig*, if necessary.

## FRENCH GLOSSARY.

*A argenter (pilules)*, to be silvered (pills).
*A broyer ou concasser*, to be crushed or broken.
*A dragéifier (pilules)*, to be coated (pills).
*A être instillé*, to be instilled
*A moins que*, unless.
*Ampoule*, blister.
*Après les repas*, after meals.
*Au-dessus*, above.
*Au poids*, by weight.
*Baguette en verre*, glass rod.
*Bien*, well.
*Bien agiter le flacon*, the bottle to be well shaken.
*Boire*, drink.
*Bouillant*, boiling.
*Chaque jour*, daily.
*Charpie*, lint.
*Chauffé*, warmed.
*Cils*, eye-lashes.
*Coeur (le)*, the heart.
*Collyre*, eye-wash.
*Comme il a été prescrit*, as directed.
*Coton hydrophile*, absorbent wool.

**French Glossary**—*continued.*

*Crépine et pulvérisateur*, spray and atomiser.
*Cuillerée*, spoonful.
*Cuillerée à dessert*, dessert-spoonful (10 gm.).
*Cuillerée à thé*, teaspoonful (*ou à café*—5 gm.).
*Cuillerée ordinaire*, tablespoonful (15 gm.).
*Cuir*, leather.
*De bonne heure demain*, early to-morrow.
*De jour en jour*, from day to day.
*De la façon habituelle*, in the usual manner.
*De la façon prescrite*, in the manner directed.
*Demain matin*, to-morrow morning.
*Demain soir*, to-morrow night.
*De temps en temps*, occasionally.
*Dissoudre*, dissolve.
*Douleur*, pain.
*Droite (à)*, to the right.
*Enème*, enema.
*En se couchant*, lying down.
*Ensemble*, together.
*Entre*, between.
*Etiquette*, slip-label.
*Etiquette avec formule*, label with formula.
*Flacon*, bottle.
*Flacon (le) ayant été agité*, the bottle having been shaken.
*Flatuosité*, flatulence.
*Fomentation*, fomentation.
*Garde-vue*, eye-shade.
*Gargariser*, gargle.
*Gencives (les)*, the gums.
*Hier*, yesterday.
*Inhalation-inhalateur*, inhalation-inhaler.
*Injecteur*, syringe.
*Injection intramusculaire*, intramuscular injection.
*Injection intraveineuse*, intravenous injection.
*Jus de citron*, lemon juice.
*Jusqu'à ce que*, up to.
*Juste avant d'aller se coucher*, just before retiring to rest.
*La hanche*, the hip.
*Lait*, milk.
*Main (la)*, the hand.
*Le (or la) même*, the same.
*Ne pas avaler*, not to be taken.
*Nuit*, night.
*Par dégrés*, by degrees.
*Paupières*, eye-lids.
*Pendant l'effervescence*, during effervescence.
*Pendant que la douleur dure*, while the pain lasts.
*Poignée*, handful.
*Pour être appliqué avec la brosse*, to be brushed.
*Pour être appliqué avec le pinceau*, to be painted.
*Pour être aspiré par les narines en renflant*, to be sniffed up the nostrils.
*Pour être injecté*, to be injected.
*Pour l'usage partiel seulement*, for local use only.
*Pour placer dans l'oeil*, to be placed in the eye.
*Pour usage extérieur*, for external use.
*Près de*, near to.
*Quand la toux est gênante*, when the cough is troublesome.
*Rince-bouche*, mouth wash.
*Sangsue*, leech.
*Sans*, without.
*Semaine*, week.
*Seul, e*, alone.
*Si nécessaire*, if necessary.
*Tasse*, cup.
*Tous les deux jours*, every other day.
*Tous les matins (soirs)*, every morning (night).
*Tous les quarts d'heure*, every quarter hour.
*Tous les trois jours*, every third day.
*Toutes les deux heures*, every two hours, or every other hour.
*Toux (la)*, the cough.
*Un blanc d'oeuf*, white of an egg.
*Une fois*, once.
*Un jaune d'oeuf*, yolk of an egg.
*Veine*, vein.
*Verre à madère*, wineglass.
*Verrée (une)*, wineglass (8 *cuillerées ordinairies*—20 gm.).
*Versez*, pour off.

## GERMAN GLOSSARY.

*Abend*, evening.
*Abkochung*, decoction.
*Abwechselnd*, alternately.
*Ader*, vein.
*Alle-Stunden-Tropfen zu nehmen*, so many drops every – hours.
*Alle viertel Stunden*, every quarter-hour.
*Alle zwei Stunden*, every other hour.
*Allmählich*, by degrees
*Anwenden*, apply.
*Atmen*, breathing.
*Auflösen*, dissolve.
*Augenlider*, eye-lids.
*Augenschirm*, eye-shade.
*Augenwasser*, eye-wash.
*Augenwimpern*, eye-lashes.
*Ausgenommen wenn*, unless

German Glossary—*continued.*

*Ausgiessen*, pour off.

*Aeusserlich anzuwenden* for external use.

*Bähung*, fomentation.

*Becher*, a cup.

*Beim zu Bett gehen*, at bedtime.

*Bis auf*, up to.

*Blähung*, flatulence.

*Blutegel*, leech.

*Brandblase*, blister.

*Bürsten*, to be brushed.

*Charpie-Bausch*, tampon.

*Der schmerzende Teil*, the painful part.

*Dasselbe*, the same.

*Dessertlöffel*, dessertspoonful.

*Diese Arznei darf nicht eingenommen werden*, not to be taken,

*Diese Arznei darf ohne erneute schriftliche Verordnung des Arztes nicht repetiert werden*, this medicine may not be repeated without written order of the physician.

*Dragieren (pillen)*, to be coated (pills).

*Drei mal täglich*, thrice daily.

*Durch die Nase einzuziehen*, to be sniffed up the nostrils.

*Ebenfalls*, also.

*Eigelb*, yolk of an egg.

*Eingeben*, administer.

*Einspritzung*, injection.

*Einspritzung in die Adern*, intravenous injection.

*Einspritzung in die Muskeln*, intramuscular injection.

*Einspritzung unter die Haut*, subcutaneous injection.

*Einzuspritzen*, to be injected.

*Einzutröpfeln*, to be instilled.

*Eiweiss*, white of an egg.

*Erbrechen*, vomiting.

*Erwärmen*, to be warmed.

*Esslöffel*, tablespoon.

*Etikette mit Rezept*, label with formula.

*Flasche*, bottle.

*Frottieren*, friction.

*Für innerlichen Gebrauch*, for internal use.

*Gelegentlich*, occasionally.

*Genau*, accurately.

*Genügend*, sufficiently.

*Gestern*, yesterday.

*Gift*, poison.

*Glaskapsel oder Phiole*, glass capsule or ampoule.

*Glasstab*, glass rod.

*Gleiche Teile*, equal parts.

*Gurgelwasser*, gargle.

*Gut*, well.

*Herz*, heart.

*Hüfte*, hip.

*Husten*, cough.

*In das Auge zu bringen*, to be placed in the eye.

*In der angegebenen Weise*, in the manner directed.

*In der gewohnten Weise*, in the usual manner.

*In gleiche Teile zu teilen*, to be divided into equal parts.

*Inhalations-Apparat*, inhaler.

*Jeden Abend*, every evening.

*Jeden Morgen*, every morning.

*Jeden zweiten Tag*, every other day.

*Klystier*, enema.

*Kochend*, boiling.

*Kurz vor dem Schlafengehen*, just before retiring to rest.

*Leder*, leather.

*Löffel*, spoon.

*Mazerieren*, macerate.

*Morgen früh*, to-morrow morning

*Mundwasser*, mouth-wash.

*Mutterzapfen*, pessary.

*Nach Anweisung*, as directed.

*Nach Bedarf*, when required.

*Nach dem Essen*, after meals.

*Nachdem man die Flasche umgeschüttelt hat*, the bottle having been first shaken.

*Nach einer Stunde*, at the expiration of an hour.

*Nach Gewicht*, by weight.

*Nahe*, near.

*Niederliegen*, lying down.

*Nur auf ärztliche Anweisung abzugeben*, to be given only on the medical man's direction.

*Nur für äusserlichen Gebrauch*, for external use only.

*Nur für örtlichen Gebrauch*, for local use only.

*Ohne*, without.

*Pinseln*, to be painted.

*Recht*, right.

*Reiben*, rub.

*Reizbar*, irritable.

*Schmerz*, pain.

*Sofort*, immediately.

*So lange der Schmerz anhält* while the pain lasts.

*Spritze*, syringe.

*Stets kühl zu halten*, to be kept cool.

*Streichen*, spread.

*Stuhlzäpfchen*, suppository.

*Stunde (Eine)* one hour.

*Täfelchen*, tablet.

*Täglich*, daily.

*Topf*, pot.

*Trunk*, draught.

*Ueber*, above.

*Uebersilbern (Pille)*, to be silvered (pill).

*Umschütteln*, to shake (the bottle).

*Verbandwatte*, absorbent wool.

*Verordnen*, prescribe.

*Von Tag zu Tag*, from day to day.

*Vor dem Gebrauch gut umzuschütteln*, to be well shaken before use.

German Glossary—*continued.*

*Vorsicht*, with care.
*Vorsichtig*, cautiously.
*Während des Aufbrausens*, during effervescence.
*Wenn der Husten belästigt*, when the cough is troublesome.
*Woche (Eine)* one week.
*Zahnfleisch*, the gums.
*Zahnreinigungsmittel*, dentifrice.
*Zerreiben oder zerbrechen*, to be crushed or broken.
*Zerstäubungs-Apparat*, spray or atomiser.
*Zitronensaft*, lemon juice.
*Zubereitet*, prepared.
*Zu gleichen Teilen*, of each equal parts.
*Zwischen*, between

## ITALIAN GLOSSARY.

*A caldo* warmed.
*A escre aspirato dalle narici*, to be sniffed up the nostrils.
*A frantumarsi o spezzarsi*, to be crushed or broken.
*Aggiungere un cucchiaino ad un mezzo litro di acqua bollente, e fare inalazioni colla evaporazione*, one teaspoonful to a " pint " of boiling water and the steam inhaled.
*Agitare la bottiglia avanti l'uso*, the bottle having been first shaken.
*A gradi*, by degrees.
*Al di sopra*, above.
*A meno che*, unless.
*A peso*, by weight.
*Apparecchio respiratorio*, respirator.
*Applicare con un pennello*, to be brushed.
*Applicare la filaccia sulla ferita frequentemente, e appena asciutta ripetere di nuovo l'applicazione*, Apply lint to the wound frequently, as soon as dry repeat the application again.
*Bacchetta di vetro*, glass rod.
*Bollire*, boiling.
*Bottiglia*, bottle.
*Candela*, bougie.
*Capsule o ampolle di vetro*, glass capsules or ampoules.
*Ciglia*, eye-lashes.
*Clistere*, Enema.
*Collirio*, eye-wash.
*Come fu detto*, as directed.
*Come fu detto avanti*, as previously directed.
*Cucchiaino da caffè*, dessertspoon (very few people take " tea " in Italy.)
*Cucchiaio*, spoonful.
*Cucchiaio da tavola*, tablespoonful
*Cuoio*, leather.
*Da applicarsi dietro l'orecchio destro*, apply behind the right ear.
*Da applicarsi eggermente prima di coricarsi*, to be applied lightly at bedtime.
*Da applicarsi sulla eruzione cutanea*, to be applied to the eczematous rash.
*Da argentarsi (pillole)*, to be silvered (pills).
*Da bere*, drink.
*Da instillarsi*, to be instilled.
*Da ricoprirsi (pillole)*, to be coated (pills).
*Da sciogliersi*, dissolve.
*Da somministrarsi*, to be administered.
*Da strofinarsi con un panno sul cuoio cappelluto sera e mattina*, to be rubbed into the bare patches on the scalp night and morning.
*Da usarsi localmente*, for local use only.
*Da vicino*, near to.
*Di giorno in giorno*, from to day day.
*Diviso in parti uguali*, of each equal parts.
*Dolore*, pain.
*Domani sera*, to-morrow night.
*Domattina*, to-morrow morning.
*Domattina presto*, early to-morrow.
*Dopo i pasti*, after meals.
*Dopo un'ora*, at the expiration of an hour.
*Esattamente*, accurately.
*Etichetta*, label.
*Etichetta con formula*, label with formula.
*Falaccia*, lint.
*Filtrare*, strain.
*Fino a*, up to.
*Fino a che dura il dolore*, while the pain last.
*Fra mezzo*, between.
*Frizioni*, friction
*Gargarizzare*, gargle.
*Giacere*, lying down.
*Giornalmente*,daily.
*Giusto*, right.
*Gocce*, drops (of liquid).
*Idrofilo*, absorbent.
*Ieri*, yesterday.
*Il cuore*, the heart.
*Inalazioni-inalatore*, inhalation-inhaler.
*Iniezione sottocutanea*, subcutaneous injection.
*Insieme*, together.
*L'anca*, the hip.
*La mano*, the hand.
*La tosse*, the cough.
*Latte*, milk.
*Le gengive*, the gums.

**Italian Glossary**—*continued*

*Lo stesso*, the same.
*Non più di 4 volte al giorno*, not more than four times a day
*Ogni due ore, Un'ora si e l'altra no*, every other hour
*Ogni quarto d'ora*, every quarter of an hour.
*Ogni sera*, every night.
*Ogni due ore*, every two hours.
*Ogni tre giorni*, every third day.
*Palpebre*, eye-lids.
*Pastiglie*, lozenges.
*Pennellare la gola ogni giorno, una mezz'ora dopo colazione*, paint the throat every day about half an hour after breakfast.
*Per iniezioni* to be injected.
*Per pennellature*, to be painted.
*Per pennellature alle narici due volte al giorno*, apply to the nostrils with a camel's hair brush twice a day.
*Per sciacquare la bocca* mouth-wash.
*Prima di coricarsi*, just before retiring to rest.
*Pure*, also.
*Quando la tosse arreca disturbo*, when the cough is troublesome.
*Sera*, night.
*Se sara necessario* if necessary.
*Settimanalmente*, weekly.
*Senza*, without.
*Siringa*, syringe.
*Sorso*, draught.
*Spruzzatore*, spray
*Stoppaccio*, tampon.
*Strofinare*, rub.
*Sugo di limone*, lemon juice.
*Tazza*, cup.
*Tre volte al giorno*, three times a day.
*Tutte le mattine*, every morning.
*Una goccia dentro la pupilla degli occhi una volta al giorno*, a drop into the lower lid of each eye once a day.
*Una manciata*, handful.
*Una settimana*. a week.
*Una volta*, once.
*Un bicchiere da vino*, wine-glass.
*Un bianco d'uovo*, white of an egg.
*Un giorno si ed un giorno no*, every other day.
*Un torlo d'uovo*, yolk of an egg.
*Un uovo*, an egg.
*Vaporizzatore*, atomiser.
*Vaso*, pot.
*Veleno*, poison.
*Vena*, vein.
*Versare*, pour off.
*Vescica*, blister.
*Vicino*, near.
*Visiera*, eye-shade.

## PORTUGUESE GLOSSARY.

*A*, the (feminine).
*Acima*, above.
*Algalia*, bougie.
*Almoço*, breakfast.
*Alternadamente*, alternately.
*Amanhã á noite*, to-morrow night.
*Amanhã pela manhã*, to-morrow morning.
*A menos que*, unless.
*A parte dorida*, the painful part.
*A pelle de craneo, couro (cabelludo)*, scalp.
*A peso*, by weight.
*Applica-se suavemente na séde da dôr*, to be applied gently to the painful part.
*Aquecido*, warmed.
*A serem cobertas (pilulas)*, to be coated (pills).
*A serem prateadas (pilulas)*, to be silvered (pills).
*A ser instillado*, to be instilled.
*A ser pincelado*, to be brushed.
*A ser pintado*, to be painted.
*As gengivas*, the gums.
*Atraz*, behind.
*Banho para o olho*, eye-wash.
*Beber*, to drink.
*Bem*, well.
*Cabelludo*, hairy.
*Calvo* bald.
*Capsulas ou ampoulas de vidro*, glass capsules or ampoules.
*Cautelosamente*, cautiously.
*Chiavena, Chicara*, cup.
*Clyster*, enema.
*Coár*, to strain.
*Colhér cheia*, spoonful.
*Colhér de chá cheia*, teaspoonful.
*Colhér de doce cheia*, dessertspoonful.
*Colhér de sopa cheia*, tablespoonful (soup-spoon).
*Com cuidado*, cautiously, with care.
*Como indicado nas instrucções*, as directed.
*Com precisão*, accurately.
*Coração, o*, the heart.
*Couro*, leather.
*Cuidadosamente*, carefully.
*De deitarse, á hora*, at bedtime.
*De dia a dia*, from day to day.
*Depois*, after.
*De tres em 3 dias*, every third day.
*De vez em quando*, occasionally.
*Direito, lado*, right side.
*Dôr*, pain.
*Em partes eguaes, de cada*, of each equal parts.
*Emquanto durar a dôr*, while pain lasts.
*Entre*, between.
*Erupção*, the rash.

**Portuguese Glossary**—*continued*

*Esfregar*, to rub.
*Estender*, to stretch, extend.
*Esterilisar*, sterilise.
*Etiqueta com formulario*, label with formula.
*Exactamente antes de retirarse para descançar*, just before retiring.
*Fios de linho*, or *lichino*, lint.
*Flatulencia*, flatulence.
*Friccionar*, rub.
*Fricção*, friction.
*Fomentação*, fomentation.
*Garganta*, the throat.
*Gargarejo*, gargle.
*Garrafa*, or *Frasco*, bottle.
*Garrafa bem agitada*, the bottle well shaken.
*Gemma d'um ovo*, yolk of egg.
*Gotas*, drops.
*Hontem*, yesterday.
*Hostia*, Cachet or wafer.
*Inhalação - inhalador*, inhalation-inhaler.
*Injecção*, injection.
*Injecção intramuscular*, intramuscular injection.
*Injecção intravenosa*, intravenous injection.
*Injecção subcutanea* (or *epidermica*), subcutaneous injection.
*Irritavel*, irritable.
*Lavagem de boca*, mouth-wash.
*Lavagem para os olhos*, eye-wash.
*Leite*, milk.
*Mais*, more.
*Mão cheia*, handful.
*Mão*, hand.
*Mesmo*, same.
*Não*, not.
*Noite*, night.
*No meio de*, in the middle of.
*O*, the (masculine).
*Orelha*, ear.
*Pala para o olho*, eye-shade.
*Palpebras*, eye-lids.
*Panella*, pot.
*Para aspirar pela ventas*, to be sniffed up the nostrils.
*Para ser*, to be.
*Para ser injectado*, to be injected.
*Para ser triturado o quebrado*, to be crushed or broken.
*Para uso esterno*, for external use.
*Pastilha*, tablet.
*Pela manha*, in the morning.
*Pellica*, kid leather.
*Perto* (*de*), *junto* (*a*), near (to).
*Pestanas*, eye-lashes.
*Pó*, powder.
*Pulverisador*, spray and atomiser.
*Quadril*, hip.
*Refeições*, meals.
*Respiração*, breathing.
*Respirador*, respirator.
*Semana, uma*, a week.
*Seringa*, syringe.
*Sitio*, place.
*Sem*, without.
*Sim*, yes.
*Sumo de Limão*, lemon juice.
*Taça*, large cup (goblet, bowl).
*Tambem*, also.
*Tampão*, tampon.
*Todos os dias*, daily.
*Tosse*, cough.
*Uma gota na palpebra inferior, de cada olho, uma vez por dia*, a drop into the lower lid of each eye once daily.
*Uma hora sim, uma não*, every other hour (one hour yes, one no).
*Uma vez*, once.
*Um dia sim outre não*, every other day.
*Vareta de vidro*, glass rod.
*Vasar*, to pour off.
*Veia*, vein.
*Veneno*, poison.
*Ventá*, nostril.
*Vesicatorio*, blister.
*Vez, cada*, each time.

## SPANISH GLOSSARY.

*Acepillarse*, to be brushed.
*Agua para lavar laboca*, mouth-wash.
*Agua para lavar los ojos*, eye-wash.
*A la hora de acostarse*, at bed-time.
*Almuerzo*, breakfast (lunch).
*Alternativamente*, alternately.
*Ampollas de vidrio*, glass ampoules.
*A no ser que*, unless.
*Aparato, de inspirar*, inhaler.
*Apliquese suavemente al sitio del dolor*, apply gently to the painful parts.
*Aspiración, breathing.*
*Atrás*, behind.
*Beber*, to drink.
*Bien*, well.
*Cabello (el) del cráneo*, the hair of the scalp.
*Cabritilla*, kid leather.
*Cadera*, hip.
*Calentado*, warmed.
*Calvo*, bald.
*Candelilla*, bougie.
*Cápsulas de vidrio*, glass capsules.
*Cerca*, near, near to.
*Colar*, to strain.
*Comidas*, meals.
*Con cuidado*, with care.
*Con precisión*, accurately.
*Corazón, el*, the heart.
*Cubrirse*, to be coated (pills).

**Spanish Glossary**—*continued.*

*Cucharada*, spoonful.
*Cucharada de postre*, dessertspoonful.
*Cucharada de sopa*, soup- or tablespoonful.
*Cucharadita de té*, teaspoonful.
*Cuero*, leather.
*Cuidadosamente*, carefully, accurately cautiously.
*De día en día*, from day to day.
*Derecha*, right (hand).
*Después*, after.
*De tres en tres dias*, every third day.
*De vez en cuando*, occasionally.
*Dolor*, pain.
*El*, the (masculine).
*En medio de*, in the middle of.
*Encías*, the gums.
*Encima*, above.
*Entre*, between.
*Esterilizar*, sterilise.
*Exactamente antes de retirarse para dormir*, just before retiring.
*Extender*, to spread.
*Frotar*, rub.
*Garganta*, the throat.
*Giro*, draft.
*Gotas*, drops.
*Hilas de lino*, lint.
*Inyección entrevenoso*, intravenous injection.
*Inyección intramuscular*, intramuscular injection.
*Inyección subcutaneo*, subcutaneous injection.
*Jeringa*, syringe.
*Jugo de limón*, lemon juice.
*La*, the (feminine).
*La parte que duele*, the painful part.
*Leche*, milk.
*Llegado*, arrived.
*Loción*, eye-wash.
*Mano*, hand
*Mañana, por la mañana*, to-morrow morning.
*Mano llena*, handful.
*Mañana por la noche*, to-morrow night.
*Más*, more.
*Mientras dura el dolor*, while the pain lasts.
*Mismo*, same.
*Nariz*, nostril.
*No*, not.
*Noche*, night.
*Oblea*, wafer.
*Orden (or Pedido)*, order.
*Oreja*, ear.
*Para inspirar por las narices*, to be sniffed up the nostrils.
*Para instilar*, to be instilled.
*Para inyector*, to be injected.
*Para ser*, to be.
*Para uso externo*, for external use.
*Párpados*, eye-lids.
*Partes iguales de los dos*, of each equal parts.
*Pestañas*, eye-lashes.
*Píldoras* (*Mézclese y hágase* 100 *Píldoras*). (*Háganse* is frequently contracted to "H"), Pills (mix and prepare 100 pills).
*Pintarse*, to be painted.
*Platearse*, to be silvered (pills).
*Polvo*, powder.
*Por la mañana*, in the morning.
*Potecillo*, pot.
*Por peso*, by weight.
*Restregar*, to rub.
*Rociador y Pulverizador*, spray and atomiser.
*Romperse*, to be crushed or broken.
*Rótulo con fórmula*, label with formula.
*Sanguijuela*, leech.
*Según se dirige*, as directed.
*Semana*, a week.
*Sin*, without.
*Sitio (or lugar)*, place.
*Tambien*, also.
*Tapón*, tampon.
*Taza*, cup (drinking) or tea cup.
*Todos los dias*, daily.
*Tos*, cough.
*Una hora si y la otra no*, every other hour.
*Una gota en el párpado inferior de cada ojo, una vez al dia*, a drop into the lower lid of each eye once daily.
*Una vez*, once.
*Un dia sí y el otro no*, every other day.
*Vaciar*, to pour off.
*Varilla de vidrio*, glass rod.
*Vejigatorio*, blister.
*Vena*, vein.
*Veneno*, poison.
*Vez una*, once (one time).
*Visera*, eye-shade.
*Yema de huevo*, yolk of egg.

The title of 'Doctor' also of 'Quack,' in many languages.—L. ii./12,188.

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